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Marketing Eggs



Farmers' Bulletin No. 1378

U. S. DEPARTMENT OF AGRICULTURE

Profitable Practices

Studies of the marketing of eggs show that many useful and profitable farm practices should be more widely followed. Some of these practices that have proved to be most useful are:

- Select laying stock able to produce eggs of good size, shape, and color; and feed and care for the hens so as to get that kind of production.
- Gather eggs frequently, and keep them in a cool, humid place to maintain the original high quality of new-laid eggs.
- See that the eggs are properly packed and are protected from heat and not subjected to excessive jolting either in handling or during their trucking to market.
- Study the available markets and select one that pays extra for extra quality; sell on a grade basis.
- Keep on studying the latest improvements in producing and marketing methods, using information available from county agents, State colleges and departments of agriculture, the U. S. Department of Agriculture, and other sources, to assure ready sales and the highest attainable net return for eggs.

More detailed suggestions appear on page 43 of this bulletin. Many State and Federal publications on specific phases of egg production and marketing also can help to put more high-quality eggs on consumers' tables and to increase the net profits to producers.

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MARKETING EGGS

POULTRY DIVISION, *Agricultural Marketing Service*¹

Importance of the Egg Industry

Eggs and poultry have always been a major source of income to farmers in the United States. In 1952, the gross farm income² from poultry and eggs was about 4 billion dollars, thus making the poultry industry third in importance as a source of income for farmers. It was exceeded only by the income from meat animals and dairy products. The income from eggs alone represented more than 55 percent of the gross farm income for eggs and poultry.

Eggs have become increasingly important economically as well as nutritionally. In the United States during the 10 years preceding World War II, egg consumption ranged from 276 to 328 eggs per person per year. During the war, egg consumption increased rapidly, reaching an average of 342 eggs per capita. In the postwar period, consumption increased to a record level of 407 eggs per person in 1952.

Sources of Eggs for Market

In the United States, according to the 1950 Census of Agriculture, more than 14 percent of the eggs sold in 1949 came from flocks of fewer than 100 chickens, 25 percent from flocks of from 100 to 200, 25 percent from flocks of from 200 to 400, and the remaining 36 percent from flocks of over 400 chickens. In terms of the number of farms involved, however, the situation is much less uniform. More than 33 percent of the farms that reported selling eggs in 1949 had less than 50 chickens per farm. Nearly 58 percent of the farms had less than 100 chickens and 83 percent of the farms reported less than 200 chickens per farm.

The trend from earlier years has been toward fewer farms with larger flocks that produce more eggs per bird.

Where Eggs Are Produced

There is a tendency for egg production to be concentrated in certain geographic regions (table 1). The 10 leading egg-producing States in 1952, in order of their importance were: Iowa, Minnesota, Pennsylvania, California, Illinois, Texas, Ohio, Indiana, Missouri, and New Jersey. The combined production of these States was 32,316 million eggs, which was more than one-half of the total production of the Nation.

¹ Earlier editions of this bulletin were written by Rob R. Slocum and Jos. Wm. Kinghorne. This revision was prepared by T. H. Pond and O. F. Johndrew, Jr., marketing specialists, and C. C. Warren and Clara H. Butler, agricultural economists, Poultry Division, AMS.

² Gross farm income is the cash receipts from farm marketings added to the value of products consumed on the farm.

The marketing problems in States that produce more eggs than they consume are different from those in States that do not produce enough eggs to satisfy their requirements. It is, therefore, important in planning a program for the marketing of eggs to know whether a State is a surplus or a deficit egg-producing State.

The numbers in figure 1 represent the net surplus or deficit supply of eggs, by States, in 1940 and 1952. The surplus or deficit is the difference between State production (farm and nonfarm production minus hatching eggs) and eggs consumed in the State (consumption is assumed to be at the U. S. per capita rate). When production exceeded average consumption in a State, it was assumed that a surplus over local needs was being produced in that year and the number has a plus sign before it. When production was less than consumption in any State, the number in that State has a minus sign before it. On this basis, the 10 leading surplus-producing States in 1940 and 1952 were as follows:

1940	1952
Iowa	Iowa
Minnesota	Minnesota
Kansas	Nebraska
Missouri	Kansas
Wisconsin	Indiana
Nebraska	South Dakota
Texas	Missouri
Indiana	Wisconsin
South Dakota	New Jersey
Washington	North Dakota

Although there has not been much change in the order of surplus-producing States since 1940, there have been some pronounced regional changes. For example, the Pacific Coast States have become greater importers of eggs than heretofore. Because of large population increases, Texas, a large exporter to other States in the past, is now a deficit producer for parts of the year. It is a surplus producer for only a short period in the spring. Production in the States in the northern part of the Corn Belt is approximately double their requirements. In the East, the most noticeable change has been in New Jersey, which in the last 12 years has changed from a deficit producer to a large surplus producer.

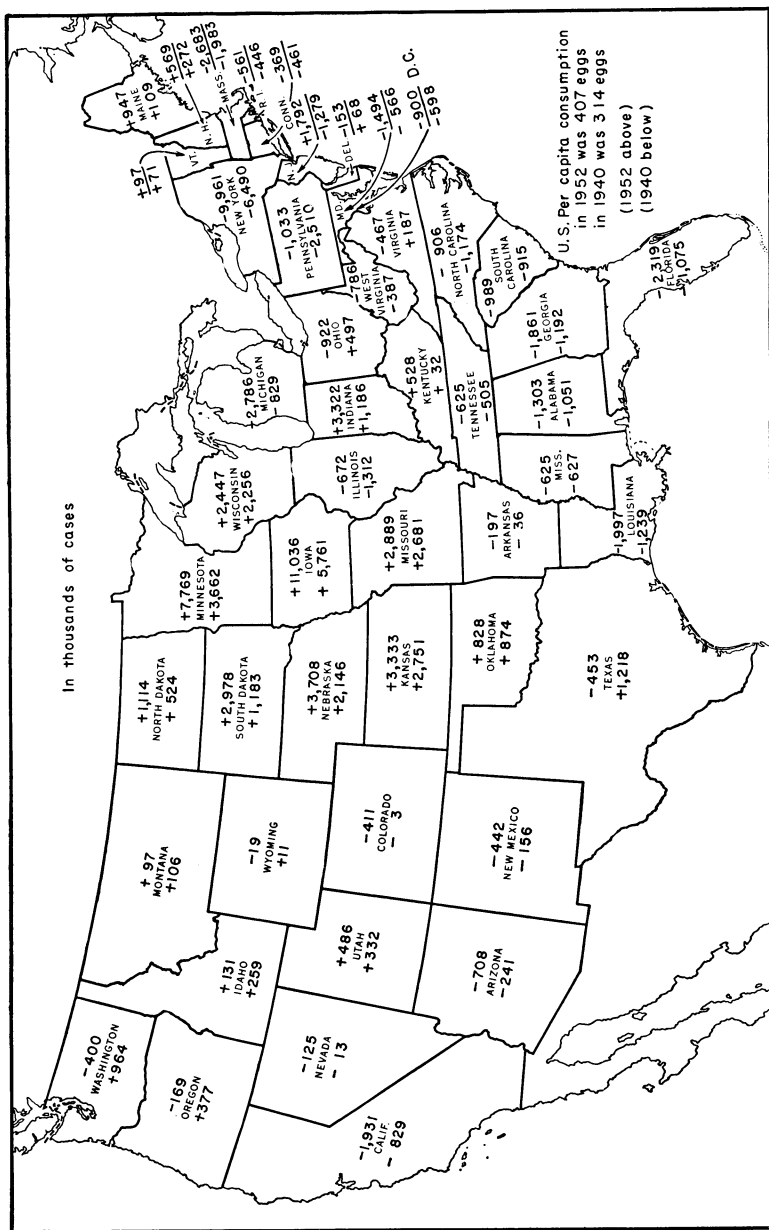
Types of Farms

Most market eggs in the United States are produced on farms where poultry is not a major enterprise. On such farms, chickens are kept to provide food for the family, to supplement cash income from other enterprises, to provide work during slack periods, or to provide a diversity of farm enterprises.

Production on commercial egg farms is a highly specialized business. In some regions such as the Northeast and the west coast, it is not uncommon to find such farms having 10,000 or more layers. Because eggs are the major source of income on such farms, emphasis is given to producing and marketing eggs of high quality.

Market eggs are also sold from poultry breeding farms and hatchery supply flocks. When the demand for hatching eggs decreases, eggs from breeding farms and hatcheries that are ordinarily used for hatching purposes are sold as market eggs.

EGGS: SURPLUS AND DEFICIT STATES 1952 AND 1940



U.S. DEPARTMENT OF AGRICULTURE
PRODUCTION AND MARKETING ADMINISTRATION
State production (farm and non-farm) minus hatching eggs and State consumption which is assumed to be at U.S. per capita rate. The sum of the State surpluses and deficits do not balance because of net exports, military use and changes in stocks.

REVISED SEPT. 1953

TABLE 1.—*Eggs produced on farms, by regions, United States, 1952*

Region ¹	Eggs produced on farms	Percentage of total farm production of eggs
	<i>Millions</i>	<i>Percent</i>
West North Central.....	16, 434	27
East North Central.....	12, 410	20
Middle Atlantic.....	8, 554	14
South Atlantic.....	5, 248	9
West South Central.....	5, 134	8
Pacific.....	4, 884	8
East South Central.....	3, 648	6
New England.....	2, 998	5
Mountain.....	1, 675	3
U. S. total.....	60, 985	100

¹ West north central region: Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, and Kansas.

East north central region: Ohio, Indiana, Illinois, Michigan, and Wisconsin.

Middle Atlantic region: New York, New Jersey, and Pennsylvania.

South Atlantic region: Delaware, Maryland, Virginia, West Virginia, North Carolina, South Carolina, Georgia, and Florida.

West south central region: Arkansas, Louisiana, Oklahoma, and Texas.

Pacific region: Washington, Oregon, and California.

East south central region: Kentucky, Tennessee, Alabama, and Mississippi.

New England region: Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut.

Mountain region: Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, and Nevada.

Planning the Farm Marketing Program

To receive the greatest possible returns from egg farming, every producer should plan a marketing program.

Developing an Egg Production Enterprise

As economic and geographic conditions differ in various parts of the country, a person already established or one who contemplates establishing himself in the egg business should become familiar with the factors discussed in this bulletin and then consult the county agent and specialists of the college of agriculture in his State. Not only the marketing part of the overall program should be discussed with these officials, but also the specific location and type of farm. Capital requirements and other management factors should be investigated thoroughly, preferably before a farm is obtained or the enterprise enlarged.

Other factors being equal, a producer is much more likely to find a more profitable nearby market outlet for his eggs in a deficit- than in a surplus-producing State (fig. 1). Ordinarily, the greater the deficit in such a State, the greater the price premiums.

Producers located near a good market, such as a fairly large city, or near several egg buyers, usually have a distinct competitive advantage. Deficit egg-producing areas in which there are densely populated sections sometimes offer opportunities for greater profits to those

who desire to concentrate on direct sales at roadside stands, or on house-to-house routes. Competition in this type of selling would be ordinarily less and the possibilities of developing more direct outlets are usually greater than in surplus egg-producing areas.

When a prospective producer plans to enter the egg business to supplement his other farm operations, or on a small-size basis (usually less than 400 hens), he should check on the relative number of egg buyers available. As the size of the egg business in this type of an undertaking will probably not be large enough to repay him for the extra services and labor involved in direct selling, competition between buyers is essential to his receiving as high a price for his eggs as possible.

Improving Marketing Practices

Several recent studies show that many producers are dissatisfied, for one reason or another, with present marketing practices and want to improve the marketing of eggs. As marketing begins with production, the producer should strive to improve his methods and practices in both production and marketing. All conditions affecting production and marketing should be carefully considered in planning each operation if producers are to realize the greatest net returns from selling their eggs.

In order to market eggs to the greatest advantage, producers should understand the factors that affect egg prices and know about local production and marketing possibilities. Thus, they should know not only about local prices for eggs and feed, but also about general economic conditions, the number of poultry on farms, the demand for hatching eggs, and the number of eggs produced on farms. Many States collect and publish much current market information, which producers can use in determining where and when to sell their products.

The U. S. Department of Agriculture publishes many reports of this kind which may be obtained by writing the Office of Information, U. S. Department of Agriculture, Washington 25, D. C. A brief description of the reports is given on p. 44.

In choosing a market outlet the producer should consider, among other factors, the number and type of market outlets available, prices and costs involved, size of flock, location, and the availability of labor for market services.

The number and type of sales outlets available in any area affect the choice of outlets made by a producer. A producer living in an area where there are several outlets of different types has, normally, a better chance of selecting a desirable outlet than does a producer located in an area where there are only a few outlets.

Producers choose the outlets they use mainly for two reasons—price and convenience. Convenience is a matter of personal desire. Prices are used many times as the sole guide in determining the outlets used by producers. The use of prices, without considering the costs involved in selling to different outlets, can be misleading.

Several recent studies have indicated that outlets to which producers sell directly, such as home consumers, hatcheries, bakeries, and restaurants, often pay higher prices for eggs than do outlets such as produce dealers, truckers, or hucksters. However, the costs involved

in selling to outlets such as the first group mentioned are sometimes so high in relation to the prices received that producers may make less profit than by selling to outlets in the second group.

Costs in selling eggs to different outlets in relation to the prices received are important in selecting a market outlet. It is well, therefore, for a producer to keep in mind that the requirements of buyers such as truckers, hucksters, and country dealers can ordinarily be met with the usual costs of production and with a minimum of marketing services being performed by him.

On the other hand, buyers such as home consumers, hatcheries, hotels, and restaurants, tend to require special services by producers who sell to them. For example, the production of hatching eggs usually demands special breeding, feeding, management, and handling in addition to costs of purchase and maintaining males in the flock. Sales direct to consumers, hotels, and restaurants usually require higher costs of packaging, selling, and delivery. Labor, which is the largest variable cost in selling eggs, amounts to considerably more in connection with performing these special services than it usually does for performing the ordinary services in selling to outlets such as country dealers, truckers, and hucksters.

The size of laying flocks kept by producers and the number of flocks in any given area influence, to some degree, the type and number of available outlets through which eggs are marketed. Specialized egg handlers are more likely to be located where flocks are numerous and large. Where small, widely scattered flocks predominate, eggs are often handled as a sideline by buyers, and the cost of the services they perform is generally higher than for such services where eggs are produced from large concentrated flocks.

Producers having large flocks usually favor produce houses in selling their eggs. These produce houses are equipped to handle large volumes of eggs regularly and more efficiently than are most other buyers. Some large-scale producers sell to hatcheries, direct to the consumer, and to other outlets, but ordinarily they sell a proportion of their eggs to produce houses.

The number of outlets used seems to depend largely on the size of flock, the producers having large flocks (400 or more hens) tending to sell to more than one outlet. In general, producers with large flocks receive higher average prices for their eggs than do producers with small flocks. Among the explanations for this may be: That producers with large flocks are selected by buyers or they find outlets that pay higher prices, that such producers are very often located in high price areas, and that producers with large flocks tend to spend more time and effort and use more modern facilities and equipment to attain and maintain high quality in producing and marketing their eggs.

The location of a producer's farm is a factor in the choice of market outlets. If the farm is located near a market having several good outlets available, the possibilities of his selecting desirable outlets are increased. On the other hand, producers may be restricted, by their location, in the choice of market outlets.

The availability of labor sometimes becomes a factor in the outlets used. For example, a producer may be able to obtain higher prices and greater profits by selling graded eggs directly to consumers. However, if he has to employ extra help to grade, package, and sell

his eggs in this manner and such labor is not readily available, labor becomes a limiting factor.

Other factors that may be considered by producers in selecting market outlets include: The necessity for providing transportation, the basis on which eggs are to be sold (graded or ungraded), the time involved in making sales, and the importance of the egg enterprise in relation to other enterprises on the farm.

Studies have shown that producers frequently do not understand the complexities and problems involved in marketing eggs. It has also been found that many egg buyers do not comprehend the problems or consider the interests of the producer. A greater mutual understanding and a better relationship between producer and buyer can be achieved if both groups attend industry meetings at which their mutual problems are discussed.

The producer should be interested in what happens to his eggs after they leave the farm, because the more efficiently and properly they are handled in marketing channels, the greater his benefits are likely to be.

Fluctuation of Egg Prices

Prices for eggs fluctuate widely during the year because of factors over which individual producers have no control (fig. 2). Even

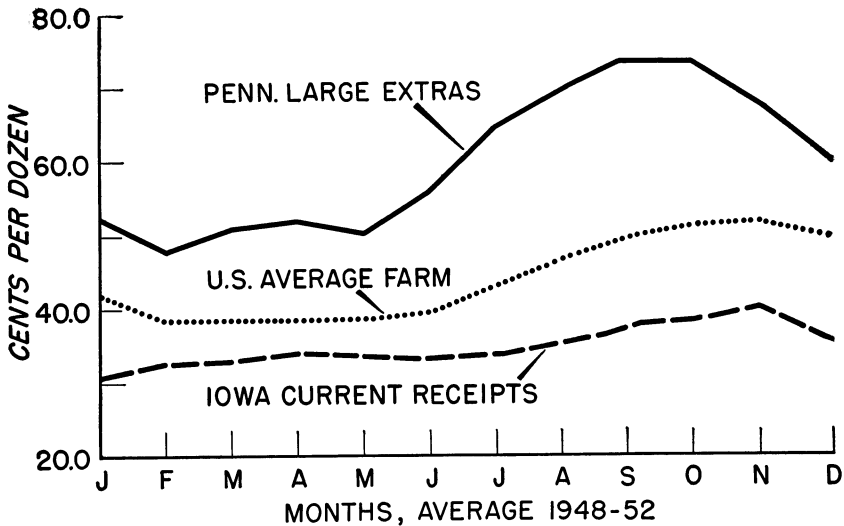


Figure 2.—Prices of Iowa current receipts, U. S. average farm prices, and prices of Large Extra white eggs at four markets in Pennsylvania, by months, 1948-52 average.

though there is much less seasonal fluctuation in egg prices now than in past years, prices vary considerably from the spring surplus-producing season to the fall months of deficit production. Midwestern current receipts, as typified by prices paid in Iowa, usually have the least seasonal fluctuation, whereas top-quality large eggs, as typified by prices paid for Large Extra white eggs at four Pennsylvania markets, usually have the greatest fluctuation (fig. 2). The United States

average farm prices, based on all grades and weights sold, show a seasonal fluctuation approximately midway between current receipts ungraded and graded top-quality eggs.

Seasonal price fluctuations are due not only to changes in the supply of eggs but also to the relative supply of various grades of eggs. For example, the supply of Grade A eggs declines and the price rises during the hot summer months, whereas the relative supply of Grade C eggs increases. As a result, there is a greater price spread between Grade A eggs and Grade C eggs. Frequently, the price of Grade C eggs does not advance at all during the summer months.

It is the consumer who finally determines the price that producers receive for their eggs. In general, the more dollars consumers have to spend, the more dollars they will spend for eggs. If egg supplies are increased in relation to the number of dollars that consumers have to spend, prices will likely go down. The price that consumers are willing to pay for eggs is also greatly influenced by the general level of prices paid for other food products. In addition, consumers eat varying quantities of eggs during different seasons of the year. Egg prices also fluctuate because of consumer preference for the grades and appearance of the eggs offered. All of these factors, including the level of supply, affect the price that producers receive for their eggs.

Although the practice of placing eggs in cold storage in the spring, the period of historically higher production, helps to reduce seasonal price fluctuations, this practice has declined in importance, because of the progressive increase in production per hen during the period July to December. Even though the season-to-season fluctuations in egg prices have been substantially reduced, there is still sufficient fluctuation to encourage farmers to produce all the eggs they can during the period from July through January. These facts stimulate producers to adopt recommended management practices such as buying early chicks, improving feeding, handling the layers carefully to avoid late summer molt, and raising pullets for laying flock replacements two or three times a year, rather than once. Egg prices are generally highest during the fall and early winter and lowest during the late winter and spring.

Producing High-Quality Eggs

The more the producer knows about an egg, the better job he can do in producing high-quality eggs, and delivering better eggs to market. Eggs are perishable. It is, therefore, important for the producer to know about the structure and composition of the egg. Figure 3 shows the parts of an egg, each of which has a bearing on its quality.

Structure and Composition of the Egg

The egg consists of three major parts: The shell and its membranes; the white, or albumen; and the yolk. An average hen's egg weighs about 2 ounces. The shell comprises approximately 11 percent, the white 58 percent, and the yolk 31 percent of the entire weight of a new-laid egg. As the egg ages, the white constitutes a decreasing percentage and the yolk an increasing percentage of the total weight.

The shell is composed largely of lime (calcium carbonate). The shell of a new-laid egg is coated with a gelatinous covering. Immedi-

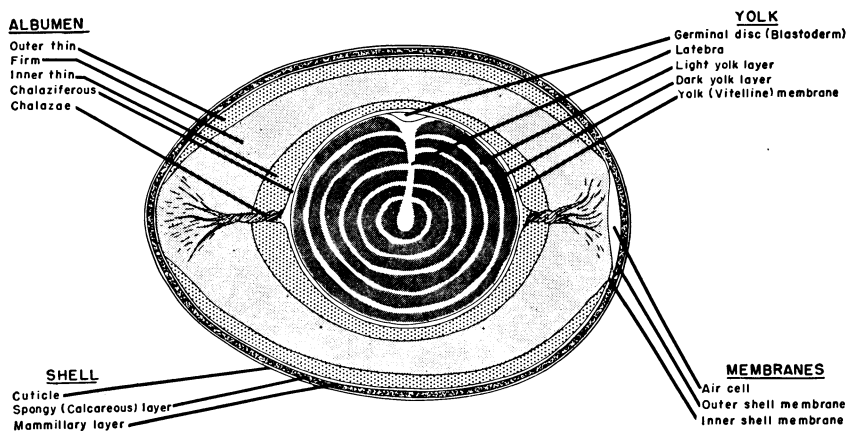


Figure 3.—The parts of an egg.

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ately within the shell are two membranes that serve as secondary protection to the egg contents. When the egg is first laid and is still warm, the contents entirely fill the shell. As the egg cools the contents shrink, and the air that is drawn through the pores of the shell causes a small space called the air cell to form between the two shell membranes, usually at the large end of the egg where these membranes separate most easily. Evaporation of water from the contents takes place with the aging of the egg, and the air cell gradually grows larger.

In a normal, new-laid egg, the white or albumen appears to be composed of two distinct parts: The thick viscous portion surrounding the yolk and a thinner portion. Actually, however, there are four parts or layers of white. The innermost, or chalaziferous, layer immediately surrounds the yolk and ends in twisted strands of thick white resembling cords. These cords are called chalazae. There are usually two of them, one on each side of the yolk. They provide an axis upon which the yolk may rotate but serve to restrict the movement of the yolk away from the center of the egg.

Next to this layer is one of thin white which is contained within the next surrounding layer, or envelope, of thick white. The remaining layer is thin white and it fills the space between the thick white and the shell membrane. Except for the chalazae, all layers of white are generally clear or transparent. In very new-laid eggs, however, and in other eggs under certain conditions, the white may be slightly cloudy. Also certain types of deterioration or certain feeds may cause the egg white to be discolored.

The yolk of the egg is suspended in the white at approximately the center of the egg and is contained by the yolk (vitelline) membrane. On the surface of the yolk, and usually on its upper side when the egg is broken out, is the germ spot or germinal disc. The germ spot in a fertile egg, under proper temperature conditions, develops into the embryo. The size of the germ spot in the fertile egg, therefore, varies,

depending on the degree to which this development has taken place. As an egg ages, the yolk tends to take up water from the white, and becomes larger, and the yolk membrane weakens, thus giving the yolk a more flattened or spread-out shape.

Abnormalities of New-Laid Eggs

In order for an egg to reach the consumer in its best possible condition, it is necessary for it to have a good shell. Eggs with soft or thin shells or having rough or rigid shells are sometimes produced. Shell thickness, although an inherited characteristic, may be influenced to a great extent by the mineral and vitamin D content in the poultry ration.

In the formation of an egg many things may affect its form or interior quality. Eggs may have large amounts of thin white, with correspondingly small amounts of thick white. Some eggs when laid may have imperfect yolks or whites, both with respect to structure and quality. Also, some eggs may contain mixed white and yolk, and are classified as mixed rots. Occasionally two or more yolks mature at the same time and start down the oviduct together, a set of albumen, shell membranes, and shell being formed around the yolks and resulting in a double-yolk egg. Occasionally small yolkless eggs are formed.

Egg quality is affected by certain respiratory diseases of the hen, the most serious being bronchitis and Newcastle disease. Poor shell quality, soft shell, thin whites, bubbly air cells, and misshapen eggs are some of the defects observed. Individual flocks may vary greatly in egg quality on recovery from Newcastle disease, but all reports to date indicate that there is damage to the eggs from such flocks and that this damage is of such magnitude as to be of commercial importance. The history of a flock with respect to Newcastle disease should be checked when attempting to uncover the cause of low interior quality.

Blood clots or spots on the surface of the yolk or floating in the white lower the quality of market eggs. These spots are caused by a rupture of one or more small blood vessels in the yolk follicle (saclike membrane), during ovulation. Any spot showing the red color typical of fresh blood is commonly referred to as a blood spot. Some spots degenerate and change in color to reddish brown, brown, tan, or white. They are then frequently referred to as meat spots. Results of studies have shown striking differences among breeds in incidence of spots. The Mediterranean breeds, such as White Leghorns, have the lowest incidence of spots and the "heavy" breeds or those laying brown-shelled eggs the highest, although this tendency will vary somewhat with different strains and particularly according to the effort to control this factor by breeding selection. If the blood or meat spots are not over $\frac{1}{8}$ of an inch in diameter, the egg may be classed as C Quality when graded according to the United States standards for quality and grade. If they are larger, the egg is classed as loss.

Eggs in which the blood has diffused throughout the albumen are known as bloody whites. These are believed to be caused by a blood clot breaking and spreading throughout the white as the egg passes down the oviduct. Eggs with bloody whites are classed inedible.

Breeding for Egg Quality

A great deal of attention should be given to the selection of the breed and strain of chickens that are to produce high-quality market eggs. Selective breeding is necessary to develop a strain of birds that will lay eggs of the desired size and shape, shell color, shell smoothness and thickness, thick albumen, and freedom from blood or meat spots. Inasmuch as these various egg-quality characteristics are inherited, both the male and female have an influence on the quality of eggs their offspring will produce. Males used for breeding should be from hens known to be producers of eggs of desirable quality. Therefore, the first step in improving egg quality is the improvement of the breeding stock.

Many researchers have definitely pointed out that the tendency of some hens to lay eggs with blood spots and watery whites is inherited. Through selective breeding, strains of layers have been developed whose eggs show high initial quality of thick white, greater shell strength, and reduced numbers of blood and meat spots. Such eggs ship better and keep better.

Research is being conducted on a national scale on the newly developed Egg Interior Quality Program, commonly known as the Egg I. Q. Program. The observations being made provide considerable information relative to the level of quality being produced by much of the country's foundation stock. New as the program is, it has definitely shown that poor quality in new-laid eggs is largely the result of inheritance and can be corrected by proper breeding.

Size and shape of eggs are important market characteristics, but each must be bred for separately, as size is not related to shape of an egg. Eggs can be too small to be of great economic value, and they can be too large for maximum net returns. Excessive egg size results in greater breakage and loss in the distribution of market eggs, and lower egg production per hen. Furthermore, excessively large eggs seldom can be sold for prices high enough to compensate adequately for their production. The most desirable and profitable egg size is an intermediate one in which the eggs range in weight from 23 to 26 ounces to the dozen.

Feeding for Egg Quality

The feeding of a good laying ration of high-quality ingredients that is properly balanced in protein, fat, carbohydrates, vitamins, and minerals is necessary in order to obtain good egg production and provide the essential nutrients for the production of quality eggs. A diet low in protein reduces egg size and number of eggs. Sufficient calcium should be provided to produce eggs with firm shells. The laying flock may be fed a complete all-mash diet but the usual practice is to feed mash and whole grain. When this is done, the grain mixture should be fed once or twice a day in amounts that provide about equal quantities of grain and mash, the proportionate amounts depending on the protein content of the mash and the rate of production.

The producer should consult his local feed dealer, extension agent, or specialists in his State college of agriculture for the latest recommendation in feeding practices.

Desirable Management Practices

The quality of eggs is affected by the management of the poultry flocks as well as by the way the eggs are handled before they are marketed. To place high-quality eggs on the market, poultrymen must give careful attention to producing them.

For market purposes, eggs should be infertile. Such eggs are produced by removing the male birds from the flock. These birds have no effect on the number of eggs a hen lays; therefore, unless the eggs are used for hatching, there is no reason for producing fertile eggs.

The problem of dirty or soiled eggs is largely one for the producer to solve. The producer is the one who benefits most from his efforts to market clean eggs and who loses most by marketing unclean eggs. The usual price spread between clean and dirty eggs (15 to 40 percent) is the best indication of the advantage to producers who keep eggs clean and marketable.

Confining the Laying Flock

To produce clean eggs, it is desirable that the laying flock be kept confined to the house or confined until the laying has been completed for the day. Hens permitted to run outside in wet weather will track mud over the eggs and reduce their market value and keeping quality regardless of how they later may be cleaned.

Providing Floor Litter and Nesting Material

Providing clean, dry floor litter helps to reduce the number of dirty eggs as the hens are less likely to carry manure on their feet to the nests. The litter should be at least 3 inches deep. As the litter becomes dirty, it should be stirred up to keep it loose and dry, and clean litter added. Good ventilation in the laying house assists in keeping the litter dry. Many types of litter are available and most are relatively inexpensive. Chopped straw, wood shavings, oat hulls, chopped corncobs or cornstalks, chopped canestalks, sawdust, or excelsior make a satisfactory litter. The type that is most convenient and economical should be used.

Screening the dropping boards or dropping pits with wire netting so that the hens keep out of their droppings results in the production of a higher percentage of clean eggs.

Providing a sufficient number of clean, dry, and sanitary nests is another practice of importance to high-quality production. The usual ratio is 1 nest for every 5 layers, or where community nests are used, 1 square foot of nest space for every 5 layers. Dark nests are desirable because birds prefer seclusion when laying and dark nests contribute to cleaner eggs. The nests should be closed at night to prevent roosting in them.

Certain types of nesting materials are effective in preventing eggs getting dirty. Highly recommended materials are shavings, rice hulls, oat hulls, sawdust, and excelsior. The nests should be made 7 inches or more deep and the nesting material should be kept dry and clean.

Gathering and Cleaning Eggs

Gathering eggs frequently is one of the most necessary of all marketing practices. Commercial egg producers usually collect eggs a

minimum of three times a day, preferably 9 to 10 a. m., 12 to 1 p. m., and again at 4 p. m., the time depending somewhat upon the season and rate of production. Wire baskets are preferred for gathering eggs (fig. 4). Frequent gathering of the eggs will reduce heat deterioration of the interior quality and result in fewer dirty, broken, and cracked eggs. The body temperature of the hen is about 107° F., therefore, the newly laid egg holds a considerable amount of body heat from the hen. The egg may stay in the nest for several hours.



Figure 4.—Gathering eggs in a wire basket.

During this period, other hens may walk over it and lay in the same nest. This keeps it warm even if the weather isn't warm. It may also become dirty.

A few eggs will be soiled and need cleaning even when laying houses and nests are kept clean. Dry buffing with emery paper or a similar abrasive is the best method for the small producer. Small spots on eggs can be removed by rubbing lightly with very fine sandpaper or emery cloth placed on a sheepskin shoe brush (fig. 5). However, if a large area of the shell surface is soiled, considerable time is required for removing the dirt. Cleaning can be speeded up by attaching emery cloth to a fleece-padded wood pulley on an electric motor. A simple direct-driven, cup-shaped buffer serves very satisfactorily. There is danger of loss from cracking or crushing eggs in the cleaning



Figure 5.—Removing shell spots and stains on eggs.

process. Most authorities agree that dry cleaning should be done as soon as possible after the soiled eggs are gathered.

Washing becomes necessary when eggs are so dirty that buffing results in an unattractive or damaged shell. However, dirty eggs should never be washed unless they are to be used immediately by the local trade. Eggs produced clean and kept clean are the most satisfactory and profitable. The main reason for the deterioration of washed eggs is the contamination of the egg content with bacteria from the dirt on the shell. Therefore, any condition that increases the chances of penetration of the egg shell by bacteria should be avoided. Clean eggs should not be washed, and it is inadvisable to place washed eggs in storage.

When cleaning dirty eggs with water, the water should at all times be warmer than the interior of the eggs. The warm water causes the liquid of the egg to expand and resist the entrance of organisms. The washing water must be clean, so it should be changed frequently. Some producers use detergents or "soapless soap" as an aid in removing dirt. Detergents as such are not bactericides. Several products now on the market combine a nontoxic germicide with a detergent. Detergent residue that remains on the eggs should be rinsed off in clean running water warmer than the eggs.

In using detergents, two containers are needed—one for the detergent solution and the other for the rinse water. With a water temperature of 120° F., the dirty eggs may be soaked in the detergent solution for not more than 3 minutes, then cleaned and rinsed in clean water with or without a germicide. Water at 120° F. is just about as hot as the hand can stand.

Immediately after the washing process, eggs should be dried with the aid of an electric fan. There are two reasons for this: (1) Evapo-

rating water helps to cool the eggs; and (2) removal of the moisture retards growth of bacteria. It is a good plan to wash eggs as soon as possible after they have been laid, but not before they have been cooled.

All eggs that are cleaned by washing should be put in separate cases from the naturally clean eggs and properly identified. All washed eggs should be moved into market channels for immediate consumption.

Problems arising from washed eggs are primarily the result of failure to follow recommended practices. Most plants that pack eggs prefer to clean dirty eggs, rather than have them cleaned on the farm. Cleaning and identifying eggs in the plant enables the plant managers to keep such eggs out of storage. Cooperative associations in certain areas are discouraging the washing of eggs on the farm and encouraging the use of mechanical dry cleaners for only slightly soiled eggs. A reduction in price per dozen is being made for washed and dirty eggs delivered by members of at least one large cooperative.

Mechanical equipment for cleaning eggs is being used on some of the large commercial farms. Many of the machines use the washing principle. Some of them submerge the eggs, some spray them, and others simulate the action of cloth scrubbers and a fan dryer.

Cooling Eggs

Cooling eggs in wire baskets is a desirable practice. Wire or rubber-coated wire baskets, or ventilated pails used for gathering eggs permit free circulation of air for more rapid cooling.

As the eggs are gathered, they should be put, basket and all, in a cool, humid place to maintain their quality and to prevent evaporation. If the eggs are gathered in a tight container, they should be transferred for cooling to a clean, wire-bottom tray. It has been found that eggs held in a wire basket require only about half as much time to cool as those held in closed containers such as tin pails, buckets, and closed baskets. If eggs are packed in cases before the animal heat has been removed, they will deteriorate more rapidly than if allowed to cool thoroughly before packing. Hence, eggs gathered one day should not be packed in cases until the next day. The eggs should be kept cool until sold.

For cooling eggs, producers make use of cellars or basements, caves, icehouses, and various types of homemade and commercial coolers. Plans with detailed specifications for popular and inexpensive coolers are available from some of the agricultural extension services of the State colleges.

An egg room that is well-ventilated, but without cross drafts, and is kept at a temperature of between 45° and 55° F., is reasonably satisfactory. Eggs deteriorate very slowly at temperatures of 29° to 31°, but very rapidly at temperatures between 65° and 100° F. It is a good plan to keep an accurate thermometer in the egg room. It may help to detect the reason for loss of egg quality.

Humidity in the egg room is of major importance. If temperatures are 45° to 55° F., a relative humidity of 70 percent appears satisfactory. With a temperature of 55° to 70°, the humidity should be about 80 percent. The humidity may be regulated by a humidifier which uses the principle of evaporation for lowering the temperature

and increasing the humidity. Commercial egg-room humidifiers are in use on some farms.

Additional humidity may be obtained by wetting the floor, by dripping water onto an excelsior-filled wire frame and blowing air on it from a fan, or by dripping water on a burlap curtain. Excessive moisture, however, may cause eggs to become musty and mold spots to develop. An electric fan directed on the walls will circulate the air and help to prevent the formation of mold.

On many farms, a part of the basement of the dwelling has been readily converted into a satisfactory egg room. A corner of the basement or cellar is best because cool wall space on two sides is provided. The other walls may be made of cinder blocks which can be erected quickly and are more resistant to moisture damage than untreated wood. A cellar window that can be left open at night will help to maintain the desired temperature during summer and will also provide ventilation. Windows should be equipped with shades to exclude the direct rays of the sun from the room. A dirt floor will sometimes provide enough moisture to keep the air in the room moist. The farm water supply drawn through sections of pipe on the walls will help to lower the temperature of the room. Wooden racks placed on the floor will provide a dry place for the cases and a comfortable place to stand and work.

A two-compartment egg room is desirable when eggs are graded for interior quality. One area should be suitable for grading, candling, cartoning, and cleaning eggs, the other equipped with a fan for cooling eggs and providing space for holding packed eggs.

There has been considerable recent development of electric refrigeration and cooling equipment which is adaptable to farm use and the use of such equipment in cooling rooms on poultry farms is rapidly increasing.

There are several types of mechanical egg coolers differing widely in the method of cooling and in the type of absorbent material used to moisten the air in front of the fan or other air-stirring device. An electrically operated egg cooler can be built cheaply and quickly (fig. 6).

Exact specifications and operating instructions for this cooler have been prepared by and are available from the Rural Electrification Administration of the United States Department of Agriculture. The plans recommend lampwicks as an absorbent material. Many egg producers, however, have found burlap effective because its open texture permits a greater passage of air. Excelsior, cotton, or other matting material may also be used. Cost of operating this cooler is negligible. A fan of household size is large enough to use in the cooler and it can be operated at a cost of only a few cents for 24 hours.

Mechanical refrigeration units which can be easily installed are being made exclusively for egg rooms (fig. 7).

It is important that any refrigeration system applied to an egg-cooling or storage installation be so designed that it will maintain a high moisture content in the atmosphere surrounding the eggs and that it will not remove large amounts of moisture from the eggs. When the temperature of large quantities of eggs is to be reduced considerably, the use of forced air over the cooling coils will speed the process, but the installation must be made so that direct blasts of air from the cooling units on the product are avoided as much as possible.

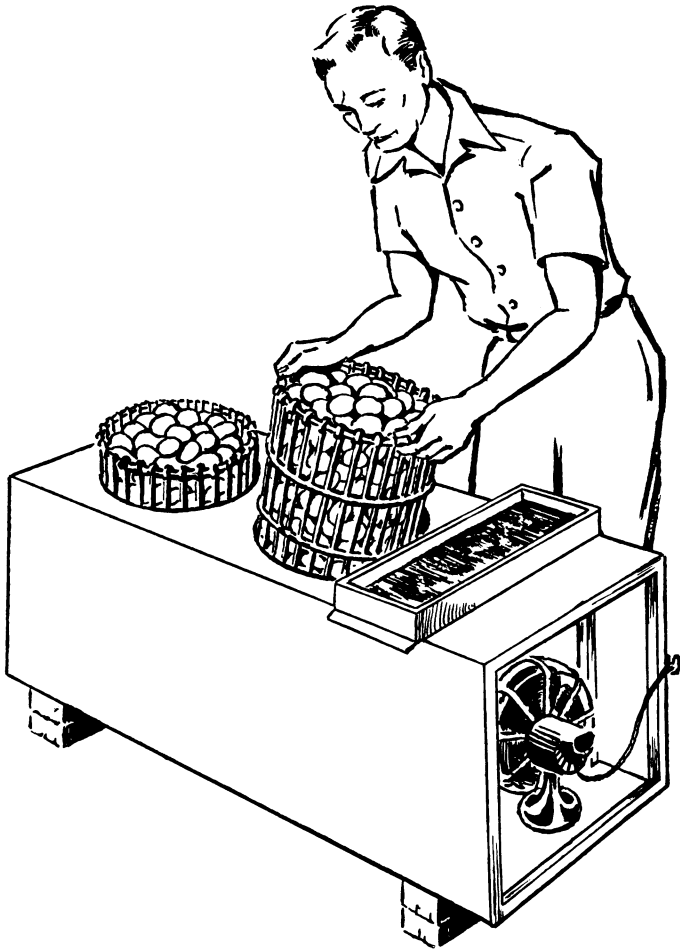


Figure 6.—This farm-built cooler is a type of wind tunnel for eggs, in which air is humified as it is driven through dampened burlap.

Ways to Greater Egg Profit

Seven widely recommended production and marketing practices were studied by the U. S. Department of Agriculture in cooperation with the agricultural experiment stations in nine Midwestern States to determine their value in maintaining quality and increasing the number of top-grade eggs that producers have to market.

The results of the study indicate that it is not sufficient for a producer to follow one or two recommended management practices in order to produce high-quality eggs. Any one practice that is undesirable may limit the quality of eggs marketed even though all other practices are good. Results of the study are reported in detail in Marketing Research Report No. 22, "Poultry Farm Practices and Egg Quality."

The report shows that the farmers who followed all seven recommended practices sold eggs that averaged 90 percent Grade A and only



Figure 7.—This cut-away model of farm refrigerated egg-holding room shows both mechanical cooling unit and section of proper insulation.

4 percent stained and dirty. As the number of recommended practices that were followed decreased, the percentage of eggs marketed that were Grade A decreased and the percentage of eggs that were stained and dirty increased. Thus, the producers following only one recommended practice marketed eggs that averaged 61 percent Grade A and 23 percent stained and dirty, whereas those following no recommended practice marketed eggs that averaged only 55 percent Grade A and 23 percent stained and dirty (fig. 8).

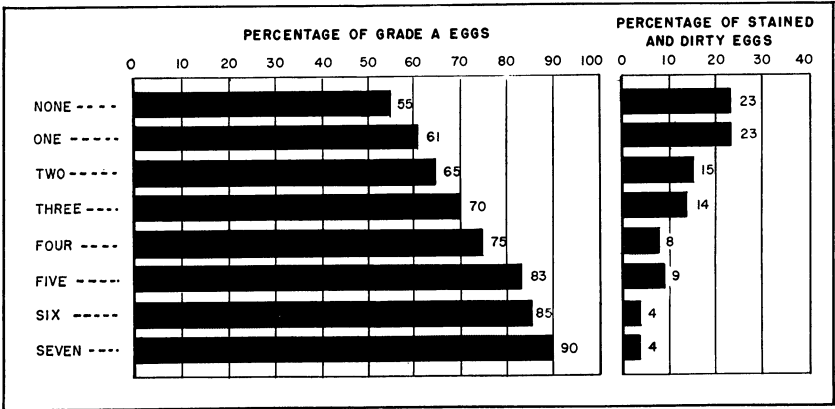


Figure 8.—Number of recommended management and handling practices followed by midwestern egg producers and percentage of eggs marketed that were (1) Grade A (from 648 farms) and (2) Stained and Dirty (from 511 farms). The practices are: Confining the laying flock; providing clean, dry floor litter; providing clean, dry nesting material; gathering eggs frequently; using wire baskets for gathering eggs; cooling the egg rooms to reasonably low temperatures; and maintaining reasonably high relative humidity.

Grading Eggs

The grading of eggs is a process of sorting them according to quality and weight and of packing each quality and weight group separately. Sometimes the word “grading” is used to refer only to the sorting of eggs for weight (size), but generally it implies sorting for all the qualities taken into consideration in packing eggs for market, including shell and interior qualities.

In the regular commercial channels of trade, eggs are often graded for the first time at the point where they are concentrated and packed for shipment to market. The candling, grading, weighing, and packing are commonly done in a single operation. The producer should learn of the candling results so that he can change his management practices to improve quality and thus obtain higher prices for his eggs. Under a program for marketing graded eggs, the eggs may be brought to a central market by the producer, but the trend is toward collecting eggs regularly and frequently from producers along established farm egg routes.

Grading for Weight

Grading for weight consists merely of sorting the eggs according to different weight classifications, as well, of course, as taking out all very dirty, or cracked, eggs and retaining these for home consumption, or for local sale, if such an outlet can be arranged. Some commercial egg farms use mechanical graders which sort eggs automatically by weight much faster than they can be sorted by hand (fig 9).



Figure 9.—Automatic electric grader sorts eggs by weight.

Weight is important as it affects prices to producers and food values to consumers. As the food value of a dozen eggs is directly proportionate to their weight, it is obvious that weight should be important in determining price. Official grades usually specify minimum net weights per dozen and per case. Eggs are classified according to their weight or size as Extra Large, Large, Medium, or Small. In manual grading for weight, a scale for weighing individual eggs is useful as a check on the grader's judgment, or when he is in doubt as to the weight classification of a particular egg. Egg scales are reasonable in price and will pay for themselves in a short time (fig 10).

Grading for Quality

All eggs sold direct to consumers should be candled to determine their interior condition, to make certain that only good, edible eggs reach consumers, and to enable consumers to purchase the quality desired. Quality is determined by four primary factors: Texture and

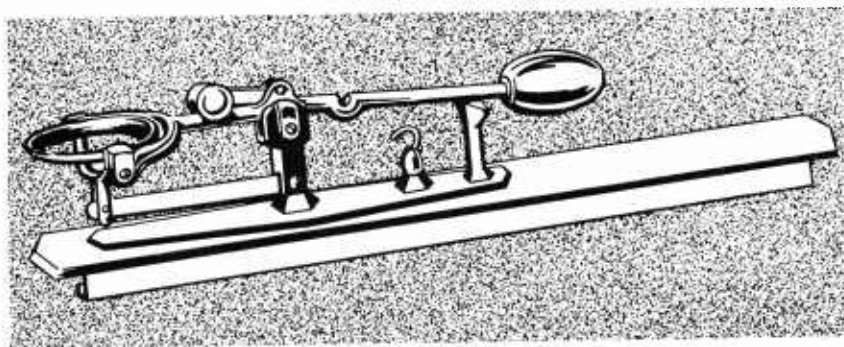


Figure 10.—One type of individual egg scale.

condition of shell, condition and size of the air cell, condition of the yolk, and condition of the white. As all of these factors, except the shell, have to do with the interior quality of the egg; they must be determined by candling.

Candling consists of holding an egg before a light projected through an opening in such a way that the rays of light penetrate the egg to a considerable extent, thus making it possible to observe the condition and behavior of the contents. The size of the light bulb used can vary considerably, depending upon the size of the opening, the position of the light with respect to the opening, whether or not a reflector is used, and the amount of light in the candling room. If a nonreflector type of light is used, a 60- to 75-watt frosted bulb mounted behind and slightly above the center of the opening is usually satisfactory.

With a reflector a lower watt bulb is ordinarily used. Care should be taken not to use a light that is too powerful, nor to project it through too large an opening, because to do so will reduce the visibility of the yolk outline and defects such as blood or meat spots. The size of the opening to which the egg is placed for examination should be no larger than $1\frac{1}{8}$ inches in diameter, or a hole slightly larger than the size of a 25-cent piece. The most satisfactory candling light for one candler might not be the best for another. Candling determinations should be checked with broken-out appearance to enhance skill in candling.

There are many different styles and types of commercial candling lights available on the market in which the light intensity and the size of the opening vary considerably. Most of these candling lights, however, are satisfactory if they are adjusted for convenient operation and proper illumination. Figure 11 shows a candling light that contains both a reflector and a convex lens and is so designed as to throw sufficient light onto the egg case or container from which the eggs are being removed for candling.

The position of the light in relation to the egg and the operator is also very important as both eyestrain and muscle strain should be avoided to achieve the utmost efficiency. A study of figure 12 may assist in the arrangement for the proper height of bench and opening of the candling lamp so that the operator stands comfortably. The light should be adjusted so that the candling light is approximately on the same level as the operator's elbows in order that he may look

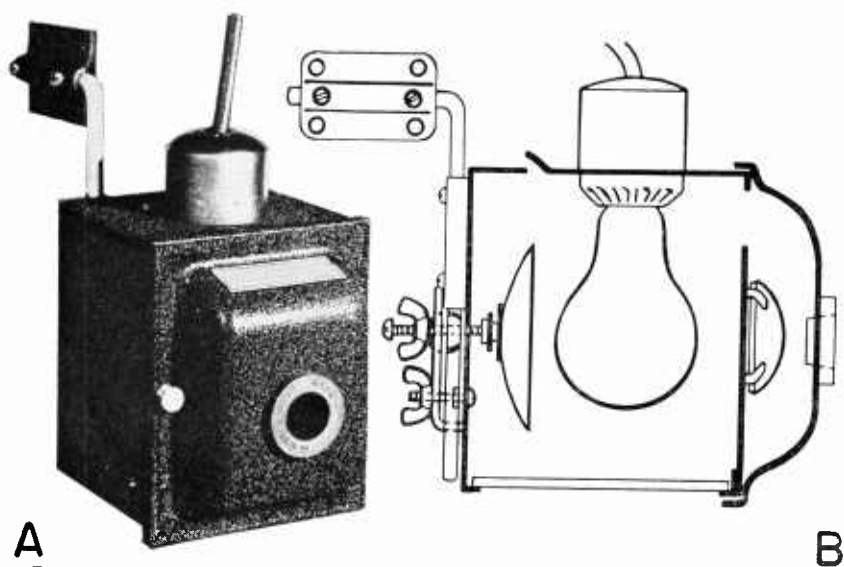


Figure 11.—A candling light having both a reflector and a convex lense.

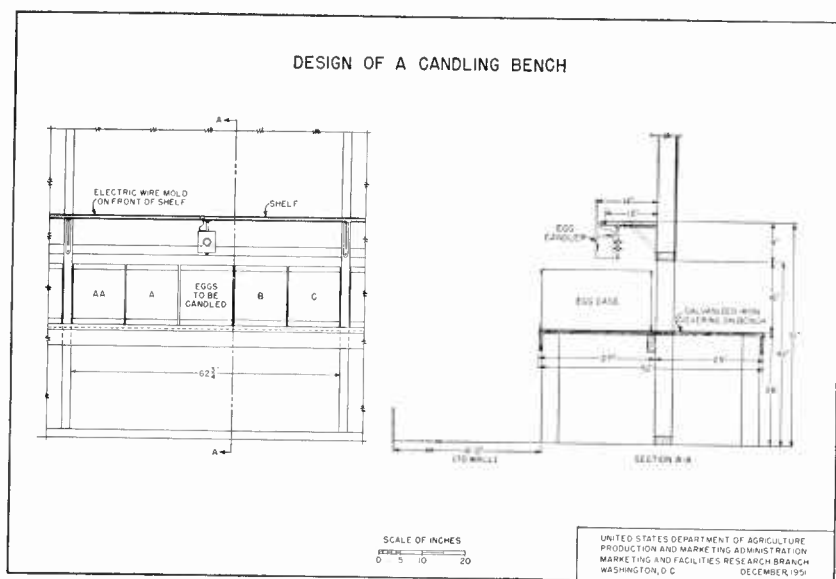


Figure 12.—Plan of construction of an egg-candling bench.

UNITED STATES STANDARDS FOR QUALITY OF INDIVIDUAL SHELL EGGS

Illustrations of candled appearance of white-shelled eggs showing maximum depth of air cell and outline and position of yolk in each quality



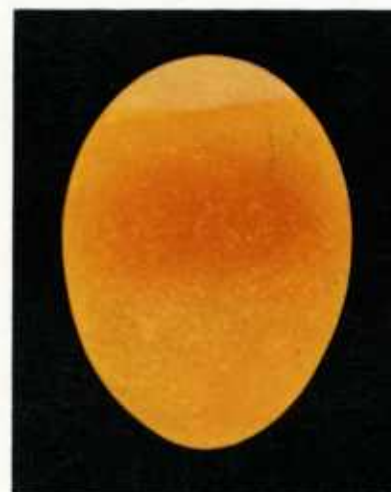
AA Quality

1. Shell—clean, unbroken, practically normal.
2. Air cell— $\frac{1}{8}$ inch or less in depth, practically regular.
3. White—clear, firm.
4. Yolk—well centered; outline slightly defined, free from defects.



A Quality

1. Shell—clean, unbroken, practically normal.
2. Air cell— $\frac{2}{8}$ inch or less in depth, practically regular.
3. White—clear; may be reasonably firm.
4. Yolk—may be fairly well centered; outline fairly well defined, practically free from defects.



B Quality

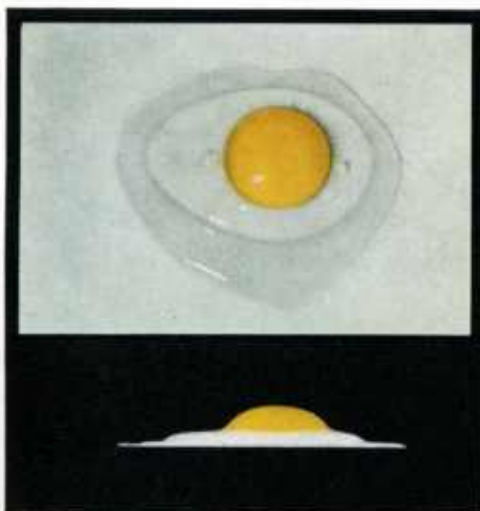
1. Shell—clean, unbroken; may be slightly abnormal.
2. Air cell— $\frac{3}{8}$ inch or less in depth; may show movement not over $\frac{3}{8}$ inch; if not over $\frac{2}{8}$ inch, may be free.
3. White—clear; may be slightly weak.
4. Yolk—may be off center; outline well defined; may be slightly enlarged and flattened; may show definite but not serious defects.



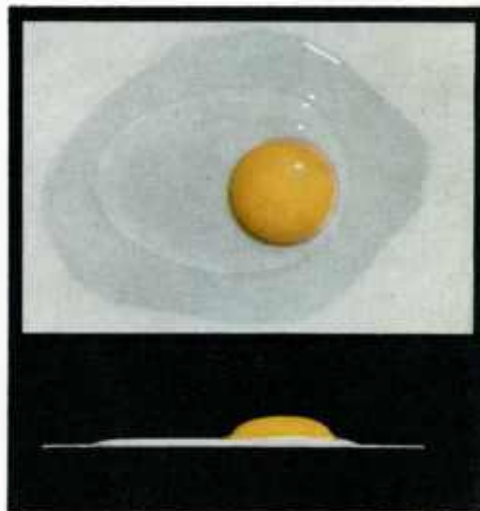
C Quality

1. Shell—clean, unbroken; may be abnormal.
2. Air cell—may be over $\frac{3}{8}$ inch in depth; may be free or bubbly.
3. White—clear; may be weak and watery; small blood clots or spots may be present.
4. Yolk—may be off center, enlarged, and flattened; may show clearly visible germ development but no blood; may show other serious defects; outline plainly visible.

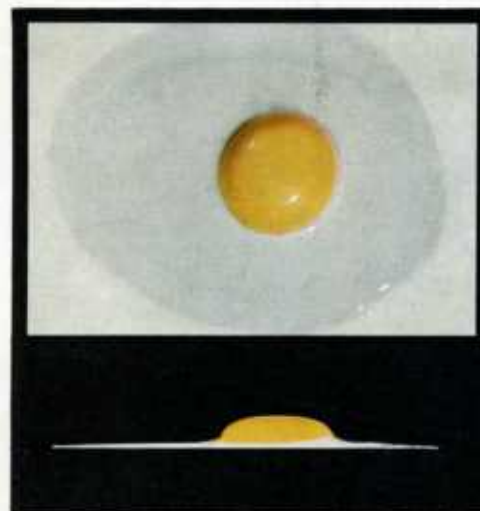
Illustrations of broken-out appearance (top and side views) of each quality— $\frac{1}{3}$ actual size



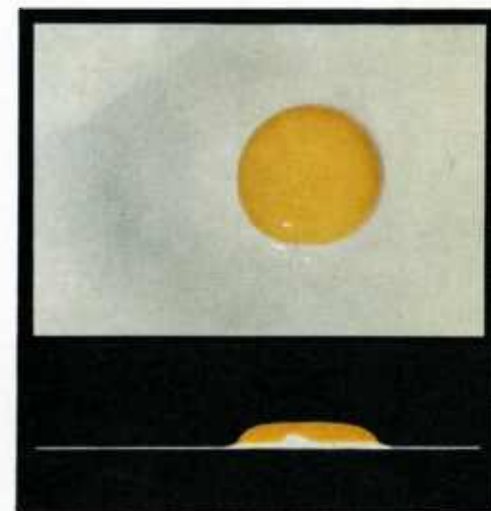
AA Egg covers small area; much thick white surrounds yolk; has small amount of thin white; yolk round and upstanding.



A Egg covers moderate area; has considerable thick white; medium amount of thin white; yolk round and upstanding.



B Egg covers wide area; has small amount of thick white; much thin white; yolk somewhat flattened and enlarged.



C Egg covers very wide area; has no thick white; large amount of thin white thinly spread; yolk very flat and enlarged.

Graders should check their work by breaking out an egg occasionally and comparing it with this chart.

down on the egg, rather than directly into the light. It is not necessary to lean over close to the egg.

When being candled, the eggs are held in a slanting position with the large end against the hole through which the light passes. The egg is grasped by the small end, and while held between the thumb and tips of the first two fingers, it is given one or two quick turns on its long axis (fig. 13). This causes the contents of the egg to move and throws the yolk nearer the shell, allowing its condition to be more carefully observed. Vigorous twirling of the egg should be avoided.

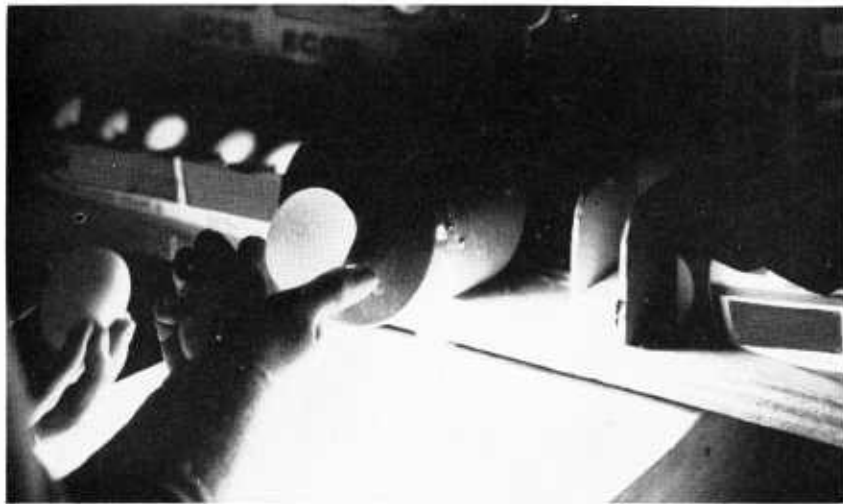


Figure 13.—The right way to hold eggs while candling.

The egg must be turned so that its entire surface is exposed to the candler's view. Otherwise, the only evidence of an undesirable condition might occur in that part not observed by the candler, and the egg might be misgraded. For the same reason, as little of the egg as possible should be obscured by the thumb and fingers holding it. The dark color of the shells of brown eggs makes them more difficult to candle than white eggs. By candling, producers should be able to distinguish the various standard qualities in eggs, and to detect obvious defects in them.

Candling is the only practical process by which the quality of eggs can be determined in the shell. It also reveals blood spots, so-called meat spots, development of the germ spot in fertile eggs, blood rings, yolks that are stuck to the shell, and other defects that make an egg objectionable or inedible. Candling need not be complicated and tedious. With practice, speed and efficiency can be attained and will be of definite benefit to most producers and handlers. The temperature of the eggs when candled should range between 50° and 70° F.

In an effort to make grading uniform in all marketing channels throughout the United States, the Department of Agriculture has formulated standards of quality applicable to individual eggs. There are eight standards for quality. Four of these are for eggs having clean, unbroken shells and are designated by the letters AA, A, B,

and C. Illustrations of these standards are shown and a summary of their specifications is given in the colored chart in the center section of this publication. The other 4 standards are described as stained, dirty, checked, and leaker. A summary of the specifications for these 4 standards is as follows: Stained—unbroken shell which may be stained or soiled; Dirty—unbroken shell which may be dirty; Checked—shell checked or cracked but not leaking; Leaker—shell broken so contents are leaking.

The standards of quality for individual shell eggs have come to be quite generally used as the principal basis of purchases by a majority of first receivers. Explanation of terms descriptive of the four primary quality factors and a more detailed discussion of these standards can be found in "United States Standards, Grades, and Weight Classes for Shell Eggs." On the basis of these standards, the Department has formulated consumer, wholesale, and procurement grades. They provide precise and acceptable definitions of quality so that producers and dealers miles apart may deal on a uniform basis.

The consumer grades are intended primarily for application to lots of eggs that have been carefully candled for retail sale. There are four consumer grades for eggs with clean shells; namely, U. S. Grade AA, U. S. Grade A, U. S. Grade B, and U. S. Grade C. Stained eggs may be packed as "U. S. Grade A, Stained" or "U. S. Grade B, Stained" if the interior quality conforms to the grade specified. A summary of standards for U. S. Consumer Grades for Shell Eggs is given in table 2.

The size or weight classes applicable to the U. S. Consumer Grades for Shell Eggs are Jumbo, Extra Large, Large, Medium, Small, and Pee wee (table 3).

Grade letters do not indicate egg size. The size is stated separately. All Grade A eggs are not large; all Grade AA eggs are not extra large, and all Grade B eggs are not small.

TABLE 2.—*Summary of Standards for U. S. Consumer Grades for Shell Eggs*

U. S. consumer grade	At least 80 percent (lot average) ¹ must be—	Tolerance permitted ²	
		Percent	Quality
Grade AA-----	AA quality-----	15 to 20----- Not over 5 ³ ----	A. B, C, stained, or check.
Grade A-----	A quality or better----	15 to 20----- Not over 5 ³ ----	B. C, stained, or check.
Grade B-----	B quality or better----	10 to 20----- Not over 10 ³ ----	C, or stained. Dirty, or check.
Grade C-----	C quality or better----	Not over 20-----	Dirty, or check.

¹ In lots of more than 30 cases, no individual case may fall below 70 percent of the specified quality and in lots of 30 cases or less, the 80-percent minimum requirement shall apply to each individual case.

² Within tolerance permitted, an allowance will be made at receiving points, or shipping destination for ½-percent leakers in Grades AA, A, and B, and 1 percent in Grade C.

³ Substitution of higher qualities for the lower qualities specified is permitted.

TABLE 3.—*U. S. Weight Classes for Consumer Grades for Shell Eggs*
(Applicable to All Consumer Grades)

Size or weight class	Minimum net weight per dozen	Minimum net weight per 30 dozen	Minimum weight for individual eggs at rate per dozen ¹
	<i>Ounces</i>	<i>Pounds</i>	<i>Ounces</i>
Jumbo.....	30	56	29
Extra Large.....	27	50½	26
Large.....	24	45	23
Medium.....	21	39½	20
Small.....	18	34	17
Peewee.....	15	28	-----

¹ Minimum weights listed for individual eggs at the rate per dozen are permitted in various size classes only to the extent that they will not reduce the net weight per dozen below the required minimum, thorough consideration being given to variable weight of individual eggs and variable efficiency of graders and scales which should be maintained on a uniform and accurate basis.

Although considerable progress has been made in establishing uniformity in grade standards, weight classes, and terminology throughout the country since early in 1923, there are still many variations in them as a result of different State laws and regulations. Producers should be familiar with the U. S. Standards and Grades, but must also keep in mind that the grades specified in the laws of the State in which the eggs are to be sold may take precedence over the U. S. Grades, unless the State law provides for the adoption of the U. S. standards and grades. Copies of the State law should be obtained from the State bureau of markets or State department of agriculture and should be studied carefully. Variations from the United States Standards for Quality, if any, are minor in most cases.

If the candler wishes to check his candling ability, more accurate and detailed information on egg quality can be obtained by breaking out questionable eggs on a flat surface, such as a piece of window glass, and studying and measuring the contents.

One of the ways of determining the quality of a broken-out egg is to judge the quality by comparison with a set of pictures of graded eggs. The egg is given the score of the picture it most nearly matches. This is called the eye-scoring method. Pictures that can be used for scoring appear in natural colors in a chart published by the Department. It pictures 12 eggs—3 for each of the 4 qualities, AA, A, B, and C. This chart shows eggs that are high, average, and low in each quality as they are usually found in market channels.

In the top AA quality eggs the thick white stands up well around the yolk, becoming progressively thinner as the quality is lowered and disappearing entirely in the lowest quality eggs. The yolks also stand up well in the higher quality eggs and are very flat and spread out in the lower quality eggs. The U. S. D. A. chart showing the egg in full size and natural color is available free in limited quantities from the Poultry Division, Agricultural Marketing Service, U. S. Department of Agriculture, Washington 25, D. C. Scoring is

easiest when the pictures are in color and show eggs the same size as when broken out of the shell. Figure 14 is a reproduction in black and white and at a reduced size of the chart.

Federal-State Grading

With the cooperation of various State departments of agriculture and extension services of the State colleges, the U. S. Department of Agriculture offers, on a voluntary and self-supporting basis, an egg-grading service that has become an important factor in egg marketing. In this service, provisions are made not only for grading shell eggs, but also for the inspection of egg products such as frozen and dried eggs. In addition, laboratory services are provided for analyzing chemical and bacteriological factors and for assisting plants manufacturing egg products in maintaining adequate and uniform quality controls. Grading under the Department's voluntary Federal-State program is conducted at almost every point in the marketing channel.

When the U. S. Department of Agriculture's grading or inspection service is used in connection with shell eggs or egg products, the "Regulations Governing the Sampling, Grading, Grade Labeling, and Supervision of Eggs and Egg Products," are applicable. When the inspection service is used in plants that manufacture egg products, the "Instructions Governing Plants Operating as Official Plants Processing and Packaging Egg Products," and the "Minimum Requirements for Facilities, Operating Procedures, and Sanitation in Official Plants Processing and Packaging Egg Products," are also applicable.

Inspection and grading programs for eggs, offered by the U. S. Department of Agriculture, are, briefly, as follows:

GRADING SHELL EGGS SOLD BY PRODUCERS ON A GRADED BASIS. Some cooperative associations and other egg buyers purchase eggs from producers on the basis of grade. In this type of operation, eggs are graded by a USDA grader who candles and grades the eggs according to the U. S. standards for quality (see p. 23). Federal-State grading supervisors make periodic checks on these gradings. Eggs may be marketed in accordance with USDA grade, either in cases or in cartons. When cartoned eggs are officially graded, the grade mark is printed on the carton or on a label used to seal the carton. The U. S. grade, size, and date of grading are indicated within the grade mark or on the tape used to seal the carton (fig. 15).

In one area of the country, marketing agencies use the grading service to establish the quality of eggs as a basis for paying producers. For this purpose, Federal-State graders make periodic gradings at the farms by examining representative samples of eggs to determine the average quality of production. Certificates that state the percentages of various qualities in the lot, are issued by these graders. On the basis of these findings, paying prices are established for a given period.

Some large commercial egg producers use the Department's grading service on a resident basis. In this connection, it should be re-

INTERIOR QUALITY OF EGGS

(Recommended standards for scoring the quality of broken-out eggs)

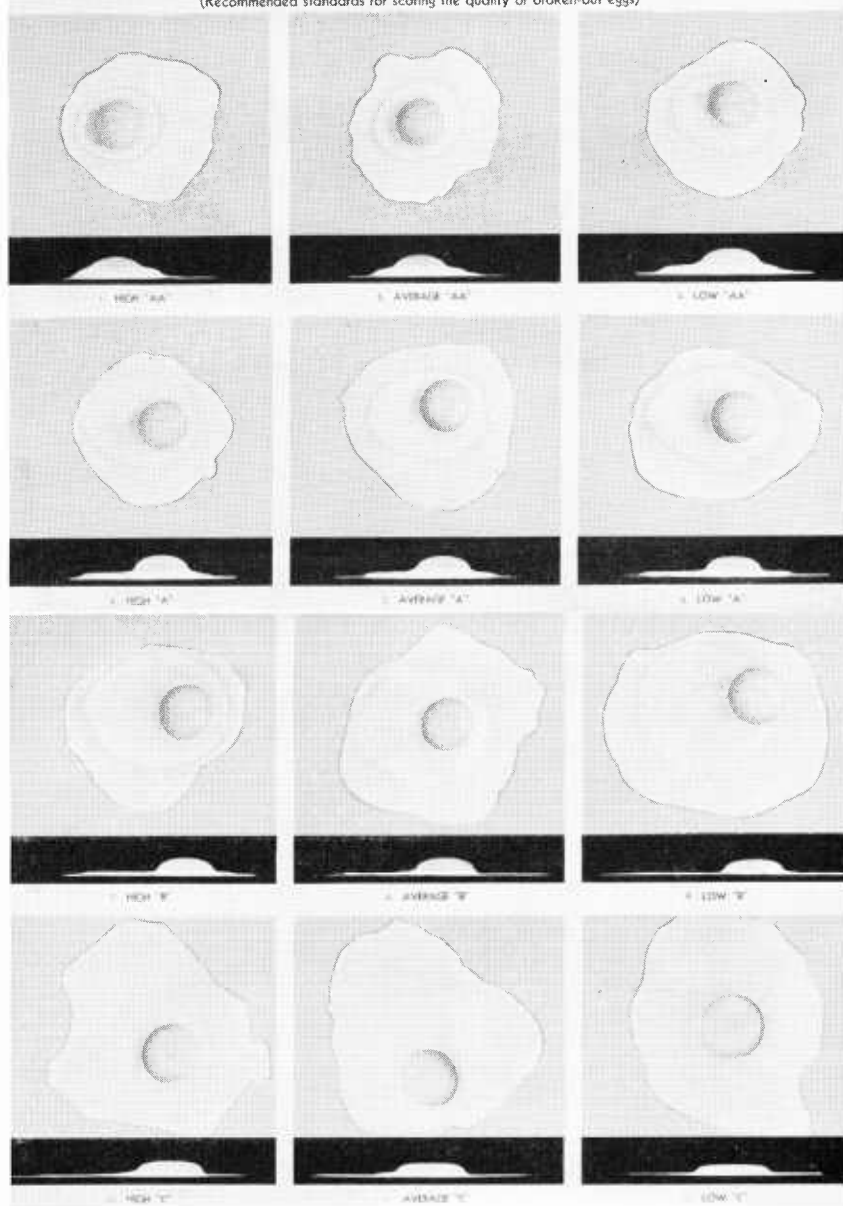


Figure 14.—The pictures on this chart show the interior quality of eggs that meet the specifications of the U. S. Standards for Quality of Individual Shell Eggs with respect to albumen and yoke quality. Quality factors dealing with the shell, air cell, and defects are not included. Scores 1, 2, and 3 represent the appearance of broken-out eggs of high, average, and low AA Quality; 4, 5, and 6 represents high, average, and low A Quality; 7, 8, and 9, high, average, and low B Quality, and 10, 11, and 12, high, average, and low C Quality.



Figure 15.—Label used to seal the carton.

membered that the Federal-State egg-grading programs are operated on a self-supporting basis, and costs are paid by the users of the service. It is therefore essential for a producer to have a sufficient volume of eggs in order to keep his costs per unit of eggs graded at a minimum. Service to smaller egg producers can be furnished more economically at the point of the first receiver.

Universal acceptance and the correct use of the Government standards and grades certified by graders, supervised by the Government, would assure producers a just and uniform grading, and make it possible to market eggs on a basis commensurate with their quality. When eggs are sold subject to grading by the buyers, the basis of grading may vary as between buyers, and from time to time, according to favorable and unfavorable market conditions. Government standards, on the other hand, are not changed to meet local or temporary market conditions or during a current marketing season. The Government graders are supervised so that producers, packers, and distributors are assured of uniform grading.

GRADING IN MARKETING CHANNELS. The Department's grading service is used at shipping points and in terminal markets. At shipping points, wholesale lots of eggs are graded by resident graders who are regularly assigned to the applicant's place of business. The eggs are mostly packed in fillers and flats or filler-flats in 30-dozen cases. Eggs are also cartoned and labeled under the supervision of resident graders at these points and packed in 30- and 15-dozen cases. In terminal markets egg handlers often request gradings of eggs in carlots and less than carlots, using the certificates as an aid in making sales or in learning the quality grade of a particular lot. At storage warehouses eggs are graded by Federal-State graders before they are placed in storage, during the period of storage, or as they leave the warehouse, the latter practice being the usual one. Shell eggs sold through the Mercantile Exchanges of Chicago and New York are now officially graded by the U. S. Department of Agriculture.

Small lots of eggs purchased by institutions on contract are graded by Federal-State graders, usually in terminal markets. Such grading is based on the examination of representative samples of the lots contracted for delivery. The grader places the stamp bearing the official grade mark or an acceptance stamp on the ends of the egg cases so graded and issues certificates denoting the grade of the eggs examined, as well as the fact that the lot meets each of the requirements contained in the specifications of the contract.

The advantages of uniform grading according to uniform standards are as great for the country packer and shipper and the city dealer as

for the producer. Under the usual commercial conditions, the terminal market receiver is handicapped in buying eggs when he buys at country shipping points that are too distant to permit personal inspection. The producer's or shipper's idea of "A" or "B" eggs may not conform to the idea of the receiver or buyer. When Government grading is used, the buyer knows what he is buying without seeing it. Buyers, therefore, have more confidence when making their purchases, and producers and shippers have less hesitancy in offering eggs for sale when they are officially graded.

When disputes arise between buyer and seller, the producer as well as the receiver has recourse to an official regrading of the eggs at terminal markets as part of the U. S. grading service.

CONTINUOUS SUPERVISION AND THE INSPECTION OF EGG PRODUCTS. Plants manufacturing dried and frozen egg products use the Department's inspection service. When plants manufacture and package egg products under the continuous supervision of a USDA licensed inspector, the entire processing operation is checked for adequacy of facilities, sanitation of equipment and operating procedures, types of raw material (breaking stock) used, and the finished egg products. Egg products that have been prepared under the inspection service may be identified with the official inspection mark (fig. 16), or by an official mark of rectangular design (fig. 17), depending on the condition of shell eggs broken for the preparation of the products.

Frozen eggs are also inspected in terminal markets. This inspection is made by drilling the solidly frozen mass and examining the product for odor and appearance. The purpose of this procedure is to determine whether or not the product is free from off-odors and is satisfactory for food.

The real value of the Department's grading service lies in the fact that grading and inspection are performed on an impartial basis. Certificates issued are acceptable in any court as prima facie evidence.

For further information about the egg grading service, write the Poultry Division, Agricultural Marketing Service, U. S. Department of Agriculture, Washington 25, D. C.



Figure 16.—The official inspection mark.

Figure 17.—An official mark of rectangular design.

Packaging Eggs

No matter how good the quality of the eggs, much of the sales value is lost if they are not well packaged. An attractive package helps to make sales, and considerable money is lost each year by operators who do not take the necessary precautions in packaging their eggs.

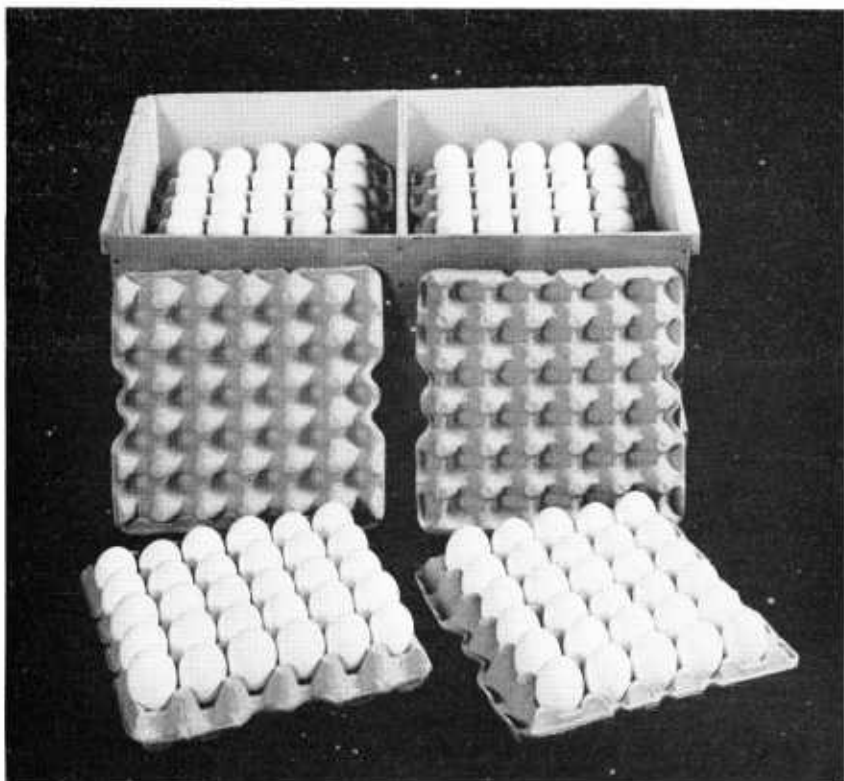
All containers and packaging materials used in packaging eggs for sale should be clean and of adequate strength to carry the eggs in good condition. All containers should be made of odorless materials that will not contaminate or lead to contamination of the product. For further information pertaining to standard shell egg packages and packaging materials, write to the Agricultural Marketing Service, U. S. Department of Agriculture, for a copy of the U. S. Specifications for Standard Shell Egg Packs, Packages, and Packaging Materials.

Packing for Shipment

The most common container used in packing eggs for shipment is the 30-dozen egg case. In this size, fiber, wooden, and wire-bound cases are made. The minimum inside dimensions of each compartment in a regular (standard) 30-dozen egg case are $11\frac{3}{4}$ inches square



Figure 18.—Two types of regular (standard) egg flats. Left, a flat with round cups; right, a flat with diamond-shape cups.



PMA 19965

Figure 19.—A standard filler-flat pack.

by 13 inches deep. The inner packing materials most commonly used in such cases are regular (standard) fillers and flats (fig. 18).

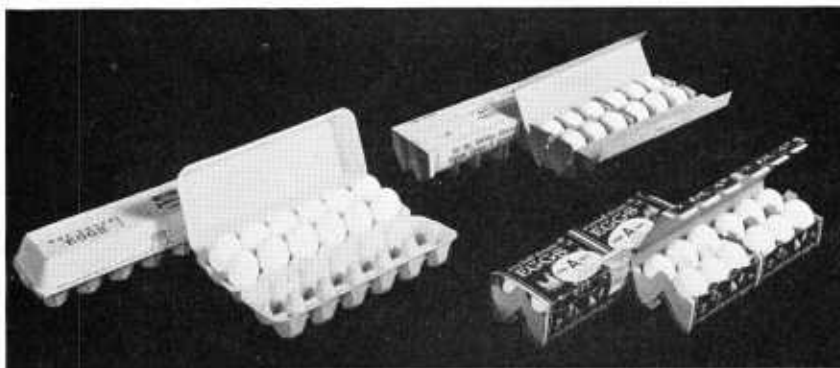
Filler-flats (fig. 19) and “2 x 6” cartons which hold 2 rows of 6 eggs each (fig. 20) are also used. A regular filler-flat for chicken eggs, is a tray having 30 individual cells arranged in 5 rows of 6 cells each, formed by the posts or prongs.

Normally, in regular 30-dozen egg cases, 10 regular fillers and 12 regular flats, or 30 regular “2 x 6” egg cartons with a flat on top or bottom of the case, or 14 egg trays, are used. When Jumbo (standard) “2 x 6” egg cartons, which are of larger size than the regular cartons, are packed in regular 30-dozen egg cases, 24 cartons are packed in each case.

Two hundred turkey or duck eggs per regular 30-dozen egg case are packed in 8 standard turkey (or duck) egg fillers and 10 standard turkey (or duck) egg flats, or in 12 standard turkey or duck egg trays.

Regular (standard) 15-dozen fiber egg cases are available for those who desire to use them. One-half the number of the specific inner packing materials mentioned above are used in these cases.

For those who make a business of producing “Jumbo” packs of chicken eggs, Jumbo 30-dozen fiber egg cases are available. These



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Figure 20.—Three styles of egg cartons.

cases are larger than the regular cases. Ten Jumbo (larger than regular) egg fillers and 12 regular egg flats are used in each of these cases. This type of pack can also be used for the shipment of hatching eggs (chicken). Special hatching egg cases, which are larger and stronger than the regular (standard) cases, are used by some hatcherymen for packing hatching eggs.

“One-trip” or “truck” fiber cases are largely used for shipments by truck. These cases are more fragile than the regular (standard) and Jumbo 30-dozen egg cases and are not as reusable. They have no stacking strength for storage and are not acceptable for rail shipments.

Producers often use second-hand cases, especially in areas close to large consuming markets, where such cases are readily available. If second-hand cases are used, they should be clean and in good repair. It is very seldom that the use of second-hand inner packing materials is desirable. Producers should keep supplies of 3-inch paper tape and threepenny, large-headed, cement-coated nails on hand for use in repairing fiber and wooden cases. All broken egg cases should be repaired promptly.

Fiber egg cases should be assembled according to manufacturers' directions. All sections of wooden cases should be assembled squarely so there are no protruding parts. Each side of regular (standard) wooden cases should be fastened with six nails in each end and six in the center; the bottom should be fastened with seven nails at each end (four in cleats and three in ends) and seven nails in the center.

Because dry egg cases absorb moisture from the eggs, empty cases should be placed in the egg-packing room a day or two before they are to be used. For the same reason, the inner packing materials from the cases should be held on racks in the egg-packing room. As an aid to preventing contamination from bacteria or molds, not more than a 2-day supply of cases should be kept in the egg-packing room at one time. The remaining supply should be held in a clean, dry place until such time as the cases are to be conditioned for use.

Eggs should always be packed with the small end down. This practice tends to hold the yolk in a normal position and helps to maintain proper physical balance in the egg. Thus, the yolk is kept away from

the shell and quality is maintained longer. Eggs packed with the large end down and then placed right side up after shipment and allowed to settle, regain very little in quality appearance. There is a tendency for the yolk to rise when the egg is packed large end down, which under certain conditions can lead to stuck yolks.

All "oversize" eggs, checks, and odd-shaped eggs should be packed by themselves. Where volume permits, brown and white eggs should be packed in separate cases. If this is not practical, pack the white eggs in one side of the case and the brown eggs in the other side.

When necessary to take up slack space and to make the pack snug in an egg case, place an extra inverted flat on top of each compartment.

The lids of fiber cases, if not of a self-locking type, should be taped so that they are securely closed. Covers of wooden cases should be nailed on one end first and then on the other end. Covers of wooden cases, except for export, should not be nailed in the center.

Packages for parcel-post shipments must be strong in order to protect the eggs properly. At the same time, they should be as light as possible to reduce shipping costs. All parcels containing eggs that are to be shipped by parcel post must be plainly marked "Eggs." When necessary, they should be marked "This side up." Egg cases, boxes, and other suitable containers can be used for parcel-post shipments so long as they comply with the postal regulations governing such shipments. These packages range in size from 1 dozen to 30 dozen. They are made of paperboard, fiberboard, wood, and metal.

Packaging for Retail Sale

For use in a display case in the farm salesroom, or in large roadside stands, or for delivery to consumers on routes, eggs can be cartoned. For this purpose, "2 by 6" cartons which hold two rows of six eggs each and "3 by 4" cartons, which hold three rows of four eggs each, are available. These cartons not only provide a more attractive means of holding eggs for display, but they also can be used as home storage containers. Such cartons satisfy the primary functions of protection, economy, convenience, and appeal. The "2 by 6" cartons are available in three sizes: Small, regular, and jumbo. Some are perforated in the middle so they can be broken in half, to become two cartons, each holding six eggs.

Selling Eggs

Eggs are a very important source of income to the producer. All the care possible in handling and preparing eggs for market will mean little if the eggs are not sold advantageously, or at the best possible price. For this reason, particular attention should be given to this phase of marketing from the farm.

Methods of Selling Eggs

Because there is considerable loss in quality in shipping eggs long distances, it is often desirable to sell them at the farm, or on a nearby market. Among the advantages in selling in this manner are: There is little loss in quality; the price to the producer is agreed on, or established before the eggs are sold; money is received at the time the

eggs are sold; a reputation for a high-quality product is more quickly established; and when selling direct to the consumer, the handling costs are reduced. Very often, a producer can receive more money for his eggs by selling direct to the consumer because the more times a product is bought and sold before it is finally consumed, the less money, in proportion, the producer can expect to receive for it. The possibilities for a producer to sell direct to the consumer depend, to a great extent, on the location of his farm in relation to the markets.

Local dealers, processors, shippers, or country storekeepers may buy eggs in a farming area. The producer may truck his own eggs to them; or these buyers may send their trucks to the farm; or the buyers may depend on egg handlers or hucksters who deliver them the quality and quantity of eggs they want.

On many main highways, roadside stands sell eggs, poultry, and other farm products. Sometimes these stands handle products from one farm and sometimes from several farms in the area. When products are obtained from the local area, the stocks of these stands are usually seasonal. In some States, roadside stand operators have formed organizations that guarantee to sell produce from only their or nearby farms. In some sections, farm salesrooms have increased in number during the last few years. They are particularly popular where a large farm specializing in eggs is established near a large consumer center.

For large roadside stands or farm sales rooms that sell a great variety of produce, display cases are available in which the temperatures can be kept below 40° F. For eggs, the temperature should be between 45° and 60°. If facilities are not available for displaying eggs in a refrigerated showcase, the eggs should be kept in a refrigerator or cooler until sold. Where cartons are desired for advertising display, empty cartons may be used.

Sometimes producers or their wives sell eggs in one of the local municipal markets, such as a "farmers" or "women's" market. This method of selling is usually carried on in connection with the selling of other farm produce. When refrigeration facilities are not available at these markets, the eggs can be kept in covered iced boxes.

Eggs are sold on egg routes or routes on which other products are sold. When eggs are sold in this way, provisions should be made for keeping them at 60° F., or under, whether deliveries are made by automobile or truck.

In many localities, producers have set up organizations to market eggs for them. Often these cooperative associations bring a large volume of similar products together, and make possible (1) more efficient packing methods; (2) more effective marketing methods; and, (3) lower handling costs.

Eggs are also shipped to consumers by parcel post.

Selling Graded Eggs

From the standpoint of the better-than-average producer, the desirability of selling eggs on the basis of their quality and weight is apparent. When buyers pay the same price for clean, large, high-quality eggs as they do for dirty, small, lower quality eggs, quality marketing is hampered. In such cases, the high-quality producer does not receive as much as his eggs are worth and the low-quality producer re-

ceives more. Usually the buyer of eggs on an ungraded basis pays an average price that is low enough to protect him against loss on the low-quality eggs. Producers may raise the price level in their community and increase their own returns by avoiding quality defects in the eggs they market. Help may be obtained in this matter from a buyer who purchases on a graded basis, or from the Extension Service.

The economic benefits of selling eggs in small quantities on the basis of standardized grades are not always realized. Small and irregular quantities cannot be assembled, transported, and distributed economically. Thus, premiums are paid not only for quality, but also for dependability and volume of supply. Therefore, it is usually only in areas that develop a reputation as a constant, dependable source of high-quality eggs that the producer receives the full benefit from a quality-improvement program.

Pricing

The price of eggs is probably the subject that the average poultryman thinks about most; yet this is the factor that is the least under his control, as price is determined largely by the supply of eggs of different qualities and the demand for such eggs. He can, perhaps, influence it to some extent by selling direct to the consumer; by finding a local or preferred market; or he can often obtain better prices through selling a graded product, or by producing a better product and selling to an agency that maintains a quality merchandising program. But in any of these cases, the price is still subject to the law of supply and demand and competitive conditions, and is influenced by daily and seasonal variations.

In selling eggs direct to consumers, it would be helpful if producers knew current wholesale and retail prices in their area when setting the retail prices to be charged. Usually, producers who consistently sell high-quality eggs ask for and obtain premiums over average retail prices in their nearest city. In establishing the retail selling price or in establishing a premium, which it is hoped may be obtained over average retail prices, consideration should be given to the extra value, if any, of the higher quality eggs being sold. If the eggs are sold on retail routes, producers may want to add to the selling price the cost of making deliveries to the consumer.

No matter what method is used in selling eggs, it should be remembered that, over a period of time, top prices cannot be obtained unless top quality is offered.

A comparison of prices of eggs of different sizes must be made within the same grade. Table 4 shows how the values of Grade A eggs of different sizes can be compared. This table can be used as a guide for establishing fair, minimum sales prices for Grade A eggs of medium and small size, once the price for large eggs is determined.

Advertising

The objective of advertising is, of course, to increase sales.

PACKAGES. Special attention should be given to the design of packages and labels. A good package should protect and preserve the contents, open and reclose easily, be of desirable shape and size, and possess distinction.

BRAND LABELS. If the quality of the product is good, these cause consumers to associate that particular name with a high-quality product.

TABLE 4.—*Comparative Values in Grade A Eggs, Based on Weight*

When <i>Large Grade</i> A eggs, with a minimum weight of 24 ounces per dozen, cost—	<i>Medium-sized</i> Grade A eggs, with a minimum weight of 21 ounces per dozen, are as good or better value at—	And <i>Small Grade</i> A eggs, with a minimum weight of 18 ounces per dozen, are as good or a better value at—
<i>Cents</i>	<i>Cents</i>	<i>Cents</i>
46-50	40-44	34-38
51-55	45-48	38-41
56-60	49-52	42-45
61-65	53-57	46-49
66-70	58-61	50-52
71-75	62-66	53-56
76-80	66-70	57-60
81-85	71-74	61-64
86-90	75-79	64-68
91-95	80-83	68-71

INSERTS in poultry cartons or packages, attractively designed and printed, should supply special information of a health, educational, or culinary nature. They may be used in a series.

OUTDOOR SIGNS, when permanent, constitute the reminder type of advertising. Temporary signs may serve in an advertising campaign. Roadside signs should always be used by producers who sell at roadside stands or retail sales rooms near the road. They should face both directions on the highway.

WINDOW DISPLAYS for those who have retail sales rooms are highly effective. A plain window sign featuring price is a good business getter.

LOCAL NEWSPAPERS AND RADIO are effective for retail advertising. Prices, which should be mentioned, can be kept in line with daily market conditions.

Transporting Eggs

Some poultrymen have their own trucks and deliver their eggs to the local market, whether it be a store, a packing plant, or a point from which shipments are made. They deliver on retail routes by truck or automobile. For this purpose, eggs should be transported in the cool part of the day, if possible. The cases should be loaded lengthwise and securely fastened in the truck. The eggs should be protected in extremely hot or cold weather. The cases in an open truck should be covered with a canvas or tarpaulin. In bad weather, side drops may be used. No more stops than are absolutely necessary should be made while en route.

If eggs are to be shipped by express, the requirements of the Official Express Classification must be met.

In transporting eggs, the producer should remember that any food that is ultimately shipped in interstate commerce or that is guaranteed to comply with the requirements of Federal law is subject to the Federal Food, Drug, and Cosmetic Act. Under this law, there are no specific regulations covering the shipment of eggs from farms, but the general provisions of the law require that products be clean, sound, and wholesome and that they be prepared, packed, and held under sanitary conditions. This law also includes certain labeling requirements. Further information on these points may be obtained from the Food and Drug Administration, Department of Health, Education, and Welfare, Washington 25, D. C.

Trucks are used extensively for the gathering of eggs from farms and carrying them to market. A study of 43 produce dealers in Indiana revealed that 86 percent of the poultry and 84 percent of the eggs handled in 1949, were collected by trucks on routes. Sixty-five percent of the 209 routes were farmer operated, 22 percent custom operated, and 13 percent dealer operated. More than three-fourths of the total volume of poultry and eggs on the routes was obtained at farm stops and the remainder at buying stations and stores. Assembly of poultry and eggs on country truck routes is a costly process, regardless of which of the three methods is used. Cooperation of producers is needed for using route labor more efficiently. Reduction in costs can benefit producers, assemblers, and consumers. All routes studied in Indiana operated on a fairly regular schedule and the eggs should have been ready for shipment when the truck arrived. However, in 42 to 57 percent of the pickups on some routes studied the driver was required to pack eggs or wait until the eggs were packed.

By Parcel Post

The parcel-post shipment of eggs to market is used principally by producers who have built up a retail trade with consumers and make shipments at regular intervals in comparatively small lots. The parcel-post shipment of market eggs is generally limited to shipments within the first and second zones, that is, within a radius of about 150 miles from the sending post office. It does not pay as a rule to ship eggs longer distances by this method because of the higher post-age rates involved.

The U. S. Post Office Department has regulations pertaining to the shipment of eggs by parcel post. Consult local post office officials.

By Motortruck

Refrigerated motortrucks, with well-insulated bodies, are used for shipping eggs in truck lots to distant terminal markets. The eggs in these trucks are usually loaded on racks.

The development of semitrailer trucks, especially those of the refrigerated type, has enabled perishable poultry products to be shipped to our leading markets from practically all parts of the country, and has enabled trucks to haul poultry products from production areas which, only 20 years ago, were too distant for transporting products by that means.

Shippers are finding the speed and flexibility of truck hauling to be a distinct advantage. Truck rates and charges generally are lower than rail rates for eggs, and differences in gross charges, therefore,

are to some degree an issue in the continuing shift from rail to trucks as the principal means of long-distance transportation of eggs. At the same time that this shift between carriers has taken place, a gradual shift in the location of egg production, in relation to population, has reduced the proportion of eggs that are hauled long distances.

When eggs are shipped by common or contract motor carriers, the rules contained in the National Motor Freight Classification apply.

By Rail

Shipments of eggs by rail freight are usually of two kinds, the local pickup freight and the through carlot shipment. Most of the pickup work of taking the eggs from the small points in comparatively small lots and delivering them at the packinghouse or other concentration point is now being performed by motortruck. At the concentration point, when shipments of eggs in carlots are to be made, refrigerator cars are used. The eggs should be well chilled before they are loaded into the cars. The refrigerator car should be iced in warm weather, crushed ice without salt being used. It is desirable to reduce the interior temperature of the car to below 40° F., before the loading of the eggs is begun.

At important shipping points, less-than-carload (l. c. l.) shipments of eggs in refrigerated cars may be arranged through freight forwarders who combine shipments so that l. c. l. shippers may gain the benefit of carload rates. In l. c. l. shipments, each case must be stenciled or tagged to show the name of the consignee and the destination.

When shipping by freight, the regulations contained in the Consolidated Freight Classification must be met. When shipping by express, the Official Express Classification must be followed.

Opportunities for Marketing Improvement

There are many factors, such as those discussed in this bulletin, that would contribute to improvements and efficiencies and reduce marketing costs.

More effective competition between fewer and better equipped local egg buyers and central assemblers in an egg-producing area that already has too many egg handlers would reduce the cost per dozen of eggs handled. An assured consistent volume of business may assist a reliable handler to be more efficient and should result in greater advantages to the producer.

A more uniform production of eggs throughout the season would reduce the unit cost of assembling and plant operations of the central assembler.

The smaller the number of agencies through which the eggs must move in the marketing process the fewer the transactions along the marketing route. This reduction in marketing functions would result in a reduction in marketing costs.

Marketing costs could also be reduced if the rate of quality deterioration at the farm, in the plants, and en route through the market channel is reduced. Buyers will gladly pay more for guaranteed uniformly graded eggs.

Costs of marketing eggs may be reduced by buying and selling by grade, particularly at country points. In general, farmers receive

more money if they sell by grade instead of on a current-receipt basis, as proved by the experience of better producers. If producers could be induced to sell and local dealers to buy on a graded basis, the return to such producers would be increased, thereby lowering the marketing margin—other factors remaining the same.

The general adoption of a single set of standards would facilitate trading and should contribute to lower costs of both wholesaling and retailing.

Producers and handlers of eggs must recognize that the possibilities of maintaining and increasing our present high rate of consumption hinges, to a large extent, on the development of a marketing program that will make it possible for consumers to buy eggs having more of their original quality. Also such a program will result in lower cost of moving eggs from producers to consumers.

Shell Protection

In recent years a method of protecting the shells of eggs commonly referred to as "shell treating" has been developed. This process consists of dipping eggs for a few seconds in a bath of colorless, odorless, and tasteless mineral oil. The viscosity of the oil used and the temperature of the application are chosen to insure the maximum coverage of the shell.³ The oil partially closes the pores in the shell and thus lessens the loss of carbon dioxide and moisture from the egg. Most of the shell-treated eggs are placed in cold storage and most of the eggs placed in cold storage are shell-treated. The process is not designed to replace cold storage but rather to improve the keeping quality of the eggs that are stored. Strict sanitation is necessary in the proper oiling of eggs. Oil that is contaminated with bacteria and mold serves to inoculate shell eggs with these organisms and their growth results in the development of mold spots and rots in storage. To prevent this condition, the oil should be removed from the machine each day, filtered through a cloth, and then sterilized by heating it to 180° F. and holding it at that temperature for 20 minutes. The oiling machine should be thoroughly cleaned before the oil is returned to it.

Another process, known as thermo-stabilization, makes it possible to retain quality in storage over a longer period than with the usual oil processing, thus offering a substantial advantage in marketing. The results of research show that the rate of deterioration of shell eggs can be retarded by dipping the eggs in oil heated to 130° to 136° F., for 16 minutes, the best results being obtained at 134°. After

³ Produce plants commonly use a paraffin base, colorless, USP, mineral oil having a viscosity of 50–60 Saybolt seconds at 100° F., pour point at 25° to 35° F., with a specific gravity of 0.825 to 0.845, and a flash point between 250° to 300°, and especially prepared for shell treating of eggs. The specific gravity is not important, but the flash point should be high in order to eliminate fire hazard. The viscosity of the oil is very important because that governs the amount of oil that will be retained on the surface of the eggs. If the oil is heated, then the viscosity changes and less oil will remain on the shell. On the other hand, if eggs are treated in a cold room, the oil will become more viscous and a shiny, sticky film will remain on the eggs. The temperature of the oils should be higher than the temperature of the egg. A common practice is to dip the eggs momentarily in heated oil which is maintained at 100° to 110°. The egg shell must be dry, since oil will not adhere to a wet shell. It is not necessary to dry oiled eggs at atmospheric temperatures. They can go into the cooler immediately.

7½ months of storage, the number of Grade A eggs remaining in the lots which had been thermostabilized averaged 84.0 percent, whereas the number in the lots that were oiled, but not heated, averaged 37.8 percent. Complete results of a study are given in Circular No. 989, "Thermostabilization of Shell Eggs; Quality Retention in Storage."

Storing Shell Eggs

The principal and most satisfactory method of preserving shell eggs, from the peak production season when prices are low to the season of lower production when prices are higher, is cold storage. The function of commercial storing is sometimes performed by the shipper and sometimes by the receiver or jobber. To fill the need for seasonal storage, independent warehouses offer space to wholesaler-jobbers and other agents.

Storage rooms for eggs must be utilized for this purpose exclusively. Other products cannot be satisfactorily stored with eggs because of the danger of imparting undesirable flavors or odors to the eggs. For the storage of eggs for extended periods, of more than a few days, the temperature of an egg storage room should be maintained within a range of 29° to 31° F. It is important that the temperature be held as even as possible. As eggs freeze at 28°, accurate temperature controls are necessary. With modern electrical equipment, it is possible to hold the temperature of closed storage rooms within 1° variation. The degree of humidity should be held just below the point at which mold is likely to grow. It is possible to maintain a humidity of more than 90 percent, provided there is good air circulation around all cases and the temperature is held between 29° and 31°. If fans are used, the air should not be blown directly against the cases. On withdrawal from storage, eggs should be carefully candled before they go to the retailer or consumer even though they were carefully candled before being stored.

The Poultry Branch of the former Production and Marketing Administration, made a study of changes in the level of quality in 104 lots of eggs held in storage in 1949. This study indicated that eggs stored early in the season, February to April, and held 30 days, and in some instances 60 days longer than those stored late in the season, did not show any greater change in the percentage of Grade A eggs, than those stored late, from May to July.

Processing Eggs

Very little egg processing is done on the farm, excepting by producers who may freeze eggs for their own use.

For Home Use

Fresh eggs may be broken and frozen for household use by producers and others who use frozen-food lockers, or who have home freezing cabinets. Eggs preserved in a home freezer or freezer-locker retain their quality much longer than eggs preserved at home in any other way. They may be broken and frozen during the season of abundance, and used during the period of scarcity and higher prices.

Fresh, clean, sound, chilled eggs are first broken into small dishes to make sure that they have no off-odor. Then they are put in a clean, large bowl and stirred with a fork or low-speed mixer just enough to break all the yolks and to mix them well with the whites without incorporation of air. The whites, when packaged separately, can be frozen without stirring and with nothing added.

Whole eggs and yolks, however, should be treated with an anti-coagulating agent to prevent gumminess in the thawed yolk substance. For this purpose, 1 tablespoon of sugar, corn sirup, or honey, or 1 teaspoon of salt may be added to every cup of yolk; 1 tablespoon of sugar, corn sirup, or honey, or one-half teaspoon of salt is added to each 2 cups of liquid whole eggs. A half-pint package is convenient for home use, since the eggs in such form should all be used promptly after thawing. It is recommended that the liquid eggs be packaged in a moisture-vaporproof container, waxed paperboard cups, fold-up cartons with cellophane liners, small glass jars, or small tin cans. A $\frac{1}{4}$ - to $\frac{1}{2}$ -inch head space should be left in all types of containers in order to allow for expansion during freezing. Freeze promptly at 0° F. or lower, and store at 0° or lower.

Freezing

Egg-breaking plants are located throughout the surplus-egg-producing sections of the country and have become large users of eggs from regular market supplies. These plants purchase eggs in direct competition with buyers of shell eggs for current use or for storage purposes.

Eggs of good interior quality are necessary for a good frozen-egg product. In the modern egg-breaking plant, shell eggs are held in a refrigerated room at a temperature of 32° to 40° F. The chilled condition of the egg minimizes the growth of most bacteria during the handling before freezing. It also facilitates the separation of the yolks from the whites when eggs are separated for the production of frozen whites and yolks. The eggs are candled to remove inedible eggs and to sort out the soiled eggs, cracks, and leakers. The candling room is maintained at a temperature of 60°. Eggs with dirty shells are washed and the shells sanitized and dried just before breaking. The checks and leakers are broken at a special table. The edible clean eggs are placed in pails and sent immediately to the breaking room, which should be well-lighted, air-conditioned, and maintained at a temperature of not over 65°. This room must be built and equipped in such manner that it can be kept clean and sanitary. It is important to hold the bacterial content of the frozen product to a minimum, and in order to accomplish this, every precaution must be taken to prevent bacterial contamination of the good eggs by any bad eggs in the breaking stock.

In the breaking room, the shell eggs are broken against a knife and the liquid contents are deposited into metal cups; or through the use of a "separator," the egg contents are separated into cups of yolks and cups of whites. When the contents of two or three eggs are accumulated in the cups, the breaker examines the cup of egg meat to determine by sight and smell that it is suitable for freezing. Cups of acceptable egg meat are emptied into small buckets and moved to the churning equipment.

The broken eggs as they accumulate, if they are to be prepared either as mixed egg or yolk, are dumped into a mixer or churn, in which they are agitated only enough to obtain a uniform mixture. A straining or centrifugal clarifying device is used to remove bits of shell membrane and shell particles. Frozen whole eggs are egg contents broken from the shells, the yolks and whites being kept in their natural proportions when broken. Some processors pack a special blend of whole eggs with additional yolk (generally 25 percent), and add a stabilizing sirup to effect uniform viscosity of the product. Frozen yolks contain not less than 43 percent total egg solids. Sugared yolks are egg yolks in which 10 percent sugar has been blended before freezing. Salted yolks have 10 percent salt added. The addition of sugar or salt to the yolk helps emulsify the product so that it thaws out smoothly without gummy or lumpy particles forming in the finished product. The whites, when packed separately, are frozen without adding any ingredient. Excessive agitation of the whites before freezing results in foaming and may alter their beating quality. The egg white may be packed without mixing to break up the thick white, or it may be mixed and thereby thinned. Methods of thinning, devised to avoid the older pressure-milling or homogenizing procedures, employ suction through fine screens or the cutting action of rapidly revolving blades.

The liquid product is placed in the final containers, usually 30-pound cans. These cans are immediately taken to a sharp-freezer, where a temperature of minus 10° F., or lower, is maintained and an air blast is generally used to expedite freezing. The liquid egg must be frozen hard as quickly as possible. For holding the product after freezing, the temperature should be 0° or below.

Frozen eggs—whole mixed, yolks, and whites—are used principally by bakers, confectioners, and ice cream, noodle, and mayonnaise manufacturers, and by food managers in hotels, hospitals, and institutions.

Frozen and dried eggs have certain advantages over shell eggs and liquid eggs for manufacturing use, especially in large-scale production. Shell eggs are bulky, fragile, and perishable, except under proper storage conditions. When frozen or dried, eggs provide the manufacturer with a more uniform product, which is compact and may be held with much less deterioration. Frozen eggs, if properly stored at 0° F., or below, and refrigerated dried eggs which are properly packaged may be held for 2 years and longer without appreciable deterioration. Dried eggs take about one-sixth the storage space and weigh about one-fifth as much as packaged shell eggs. Care in defrosting frozen eggs and in reconstituting dried eggs is necessary to bring about the best qualities in the processed eggs.

Drying

The conditions and equipment needed to dry eggs are such that small or home-scale operations are not practical. In preparation for drying, the eggs are broken in the same way as in preparation for freezing. The eggs may then be processed as dried whole eggs, dried egg yolks, or dried egg whites. Dried egg products are also called egg solids.

The customary manner of drying whole egg is to spray the liquid mixture into a heated chamber. Liquid egg from the breaking room is thoroughly mixed and strained. It is then usually preheated quickly

to about 140° F., to improve the drying operation. The warm liquid, under a pressure of 2,000 to 6,000 pounds to the square inch, is sprayed from nozzles into a larger drier chamber, through which a stream of air is passing at 250° to 300°. The air picks up moisture from the eggs and leaves the chamber at 140° to 180°. The egg powder settles in the bottom of the main chamber, from which it is continuously withdrawn. Egg yolk solids are prepared by spray-drying processes similar to those used to prepare whole egg solids. Egg white solids are prepared to only a limited extent by spray-drying.

The common method of preparing egg white solids is to place the liquid egg whites in tanks in which they are subjected to treatment to hasten the breakdown of the thick white and to remove the natural sugar. The treated egg white is then drawn into shallow pans which are placed in heated cabinets and left there until the egg white has dried. The dried egg white is then loosened from the pans, broken up in flakes or ground, if desired, and packed in barrels, drums, or other containers.

Egg solids are best adapted to large-scale usage, such as in the manufacture of noodles, macaroni, prepared flour mixes, and prepared ice-cream powders and mixes.

Prepared flour and baking mixes, the use of which is increasing, offer an important field of expansion for dried-egg products. Yolk solids are used in ready-mixed doughnut, waffle, muffin, and cake flours to give color and richness. Egg white solids are used a great deal in candy bars and in prepared whipping powders and meringue and by confectioners in making cream centers, nougatines, and marshmallow whips. Some baking powders have small quantities of egg white solids added as an inhibitor or dilutant. Small-scale bakers whose shops lack refrigeration facilities find egg solids convenient to use.

Important Steps in Marketing Eggs

In planning an egg marketing program, producers should • • •

● 1. Consider the number and type of market outlets available, prices paid, and costs involved in selling to the different outlets, size of flock, location, and the availability of labor for marketing services, in selecting a market outlet, where such a selection is possible.

● 2. Become acquainted with existing Federal, State, and municipal regulations that pertain to transporting, selling, and other applicable operations.

● 3. Obtain assistance by discussing marketing factors as well as production and farm management factors with the county agents and the poultry marketing specialists in the State colleges and departments of agriculture.

● 4. Become active in industry affairs. Attend industry meetings. Attempt to improve producer-buyer relations.

In producing high-quality eggs, producers should • • •

● 1. Give attention to the selection of breed and strain of the chickens. Use stock bred for: Egg size, shape, and color; shell smoothness and thickness; thick albumen and freedom from meat and blood spots. Buy from a reputable hatchery whose chicks are proving successful for other producers.

- 2. Feed a balanced ration to produce a maximum number of good-quality eggs with strong shells. Supplement grain rations with proteins, minerals, and vitamins.

- 3. Produce infertile eggs for market.

In following desirable management practices ● ● ●

- 1. Confine laying flocks.
- 2. Provide clean, dry nesting material and floor litter.
- 3. Gather eggs frequently in wire baskets.
- 4. Cool eggs properly before packing and keep them cool.
- 5. Maintain proper temperature and humidity in holding and storage rooms.

In preparing eggs for market ● ● ●

- 1. Grade the eggs.
- 2. Pack them according to the preferences of the market. Pack together eggs of the same color, weight (size), and as nearly as possible the same shape; pack eggs small end down in cases or cartons.
- 3. Use clean, sufficiently strong containers, fillers and flats or cartons, made from materials that will not transmit odors to the eggs. If eggs are cartoned for retail sale, use attractive labels.
- 4. Hold eggs at low temperatures preferably not above 45° to 60° F. and at a relative humidity of 70 to 80 percent.
- 5. If eggs are to be shipped, mark the packages plainly with the name and address of the receiver and shipper, and the gross, tare, and net weights.

In selling eggs ● ● ●

- 1. Investigate nearby market outlets first. Nearby selling often results in greater net returns.
- 2. Consider prevailing prices for eggs in all available markets before selling.
- 3. In retailing eggs, take quality, packaging, and labor as well as other necessary costs into consideration in establishing a retail sales price.
- 4. Sell eggs on a graded basis.
- 5. Market eggs at least twice a week, especially during the summer.

In transporting eggs ● ● ●

- 1. Protect eggs from the heat and sun with a tarpaulin or similar covering over the cases.
- 2. Avoid all unnecessary jarring of eggs. Secure cases in trucks or cars so as to minimize their movement.
- 3. Provide some means for maintaining temperature of eggs below 60° F. while making local deliveries.

Available Market Information

The U. S. Department of Agriculture collects and publishes a great deal of current information, most of which can be obtained without cost by writing to the Office of Information, U. S. Department of Agriculture, Washington 25, D. C.

DAILY MARKET REPORTS. Egg producers have available daily market quotations of prices being paid in wholesale channels in many large cities. In addition to prices, these reports indicate the condition of the market, that is, whether weak, steady, or firm, the demand for various grades of eggs, supply conditions, and other information relative to the general market situation. In some areas, daily reports are being issued which show the prices being paid producers for eggs of various grades.

BROILER CHICK REPORTS. These reports, issued weekly, indicate the number of eggs set, chicks hatched, chicks placed on farms for broiler production in each of the major production areas, and chickens marketed. By analyzing these data, egg producers can observe the demand for hatching eggs. If this demand should decline sharply as it does occasionally, there often follows a reaction in wholesale prices as shipments from hatching egg producers are sent to market.

COLD STORAGE REPORTS. The total quantities of shell and frozen eggs in cold storage on the last day of every month are indicated in these reports. The size of the month-to-month changes in these figures, as well as the total quantities held, materially influence egg prices.

CROP PRODUCTION REPORTS. These reports give a monthly record of the number of layers on farms, the number of eggs produced on farms, and the number of young chickens on farms being raised for flock replacement purposes. These data can be used to estimate the probable production of eggs in the near future on a national as well as a State basis.

INTENTIONS REPORTS. Early each year, a large number of farmers are asked how many chickens they plan to raise during the current year. Although it seldom happens that they raise exactly as many as stated, these reports do indicate rather accurately whether egg production will be up or down, and, in general, how much. These reports, like three of the reports just mentioned, indicate in general the size of egg supplies in the coming months. Since total supplies influence prices, these reports should be carefully considered by the egg producer.

POULTRY AND EGG SITUATION REPORTS. These reports, which are published bimonthly, should be studied by every specialized egg producer. They summarize the information on production, stocks, prices, and demand, which are important guides in evaluating the current and prospective egg situation.

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MOTION PICTURES AVAILABLE

The U. S. Department of Agriculture motion pictures indicated below contain information on egg production and marketing. Information on the availability of these films, and how to obtain a print for showing may be obtained from the Motion Picture Service, Office of Information, U. S. Department of Agriculture, Washington 25, D. C.

CULL FOR PROFIT. (9 minutes, sound, color, 16 mm.) Shows the times when it is economical and convenient to cull low-producing poultry and describes the physical characteristics to look for in determining which birds to unload and which ones to keep. Available for television use.

KNOW THE EGGS YOU BUY. (5 minutes, sound, b/w, 16 mm.) Shows the candling, sorting, and labeling of eggs; the meaning of grade labels, and the uses for different grades of eggs. Available for television use.

SELECTING HENS FOR EGG PRODUCTION. (5 minutes, sound, b/w, 16 mm.) Explains the principles and importance of selecting "producers" among laying hens; shows desirable and undesirable birds and the best culling practices. Prepared primarily for television.